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Lemmonier
A SYNOPSIS

OF

NATURAL HISTORY:

EMBRACING THE

NATURAL HISTORY OF ANIMALS,

WITH

HUMAN AND GENERAL ANIMAL PHYSIOLOGY,
BOTANY, VEGETABLE PHYSIOLOGY AND GEOLOGY.

TRANSLATED

FROM THE LATEST FRENCH EDITION OF

[Louis Céran] C. LEMMONNIER,

PROFESSOR OF NATURAL HISTORY IN THE ROYAL COLLEGE OF CHARLEMAGNE;

WITH ADDITIONS FROM THE

WORKS OF CUVIER, DUMARIL, LACEPEDE, ETC.;

AND ARRANGED AS A

TEXT BOOK FOR SCHOOLS.

BY THOMAS WYATT, A.M.,

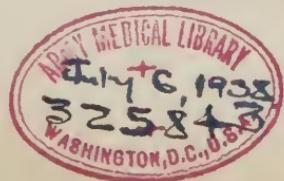
AUTHOR OF ELEMENTS OF BOTANY, MANUAL OF CONCHOLOGY, ETC.

Illustrated by Plates.

PHILADELPHIA:

THOMAS WARDLE, 15 MINOR STREET.

MDCCLXXXIX.



QH
L559P
1839

Entered, according to the act of congress, in the year 1839, by THOMAS WYATT, in the
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INTRODUCTION.

THE Work here presented to the public was undertaken with the hope of supplying, in part at least, what seemed a remarkable deficiency in the course of academical study pursued throughout the United States, under the general, but not often rigidly defined appellation of Natural History.

In the respective departments of the Natural History of Animals, exclusive of Conchology and Human Physiology, in this latter science itself, in Botany with Vegetable Physiology, and in Geology, although much remains to be done, still there appears no absolute *hiatus*, in regard to the necessary text books. I say in these respective departments; but it must have occurred to every scientific man who thinks upon the subject, as singular, that in a science whose very existence may be truly said to depend upon *method*, there should have been no attempt made to collect the parts into a readily discernible *whole*. The entire course of Natural History, as now taught, is only gleaned by the Student from a variety of distinct sources—sources differing in manner, and often (from the very nature of sciences not included among “the exact”) discordant, and often conflicting, in the more important particulars of matter and arrangement. A perfect remedy for this latter evil could, perhaps, be found only in a work of magnitude, and consequent expense, unfitting it for general dissemination. It is, however, not so much in any thing of this extended character, as in a well digested and fully comprehensive *Synopsis* that we are deficient.

A compendium appears to be wanting, which, discarding

the weakness of a merely entertaining selection, shall rigidly retain all which bears upon the ruling feature of a proper Natural History—the feature of a *lucidus ordo*.

There can be no doubt that, absolutely considered, the tabular form would be the best for such a purpose; and accordingly we find that in France, M. Lemmonnier has acquired much celebrity by his well arranged system, on which this work is based.

But what, in a scientific point of view, is certainly an advantage, has, in other respects, a very serious inconvenience. The tabular form, where the matter, as in Natural History, is essentially complex, and subdivision is piled, as it were, upon division, will admit of little or no letter press, and requires that the whole pass into the hands of the engraver. The expense is of course enormous, and renders the book a dead letter, as far as regards its common academical use.

In the volume now offered, the author has ventured so to modify that of M. Lemmonnier, as to dismiss the *body* of his tableaux, retaining as much of their *spirit* as was compatible with the objects in view, and giving many useful additions from the works of Cuvier, Dumaril, Lacepède, and other well known naturalists. The Botanic System of Linnaeus is preserved, as in the French original.

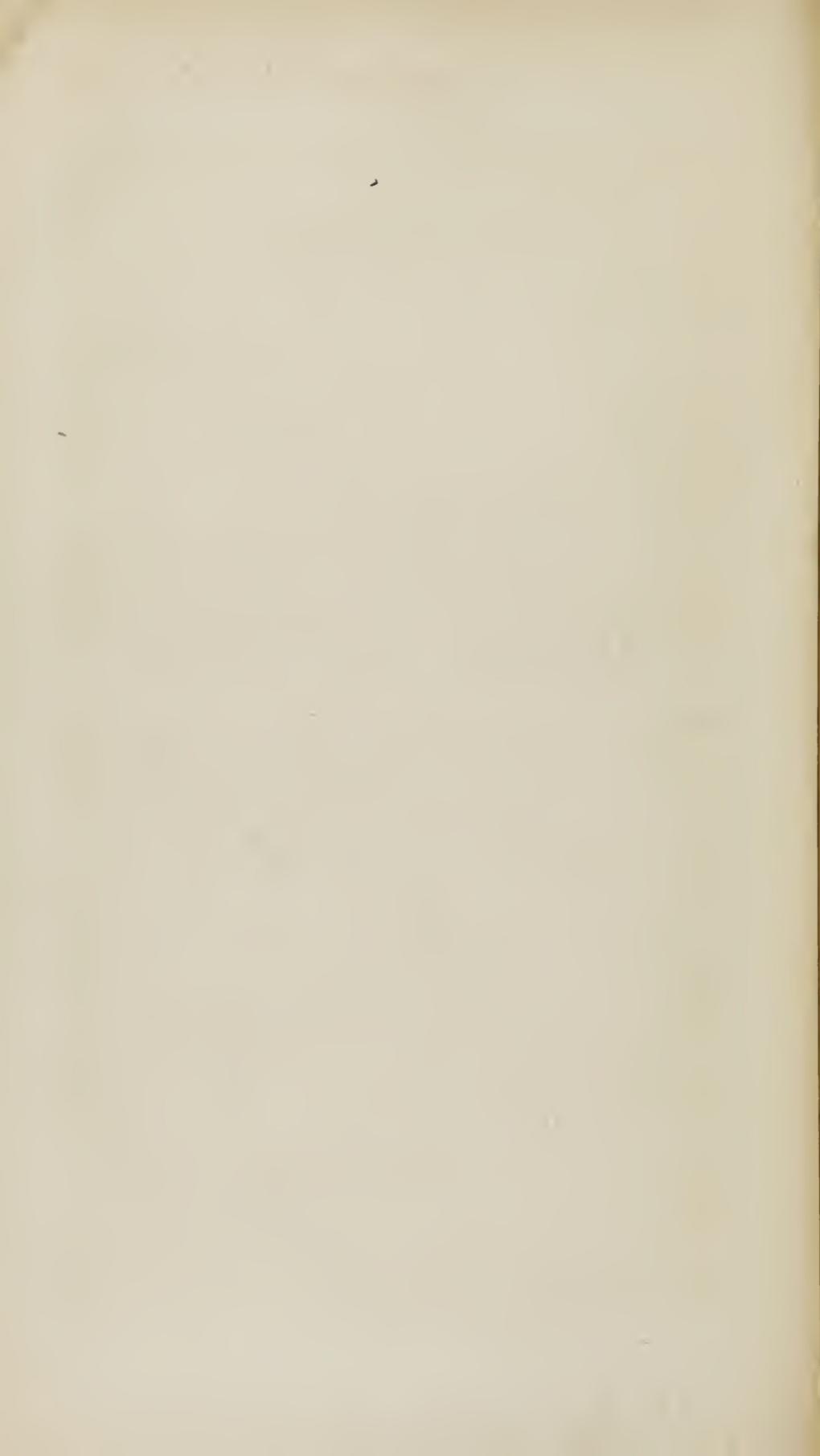
For a further progress in the science, Dr Comstock's Introduction to Botany may be confidently recommended, as a valuable work for Students. Also to Students in Geology, who wish to extend their inquiries, we would respectfully recommend "Lyell's Elements of Geology," for a first book, and his larger work, entitled, "Lyell's Principles of Geology," both of which are written in the most attractive style, and abundantly illustrated by coloured plates, maps, &c., just published by Kay & Brother, Chestnut street, Philadelphia. (See London Quarterly Review and Silliman's Journal of Science, for notices of Mr Lyell's works.)

In conclusion, our grateful thanks are tendered to Dr R. Bridges of Philadelphia, whose valuable assistance has largely contributed to the accuracy and usefulness of this volume; also to Dr H. M'Murtrie, and his excellent translation of Cuvier, which leaves nothing further to be desired, either by the teacher or the pupil.

T. W.



A N I M A L K I N G D O M .



PHYSIOLOGY.

PHYSIOLOGY is a science which treats of the phenomena or functions whose union constitutes life. These functions may be distinguished into those which are intended to connect the living being with the surrounding world ; these are called *functions of relation*, and belong only to animals : and those whose object is the preservation of the individual ; these are common to vegetables and animals, and are called *functions of nutrition*. The instruments by means of which the functions are accomplished are denominated *organs*. Several of these united for the same end form an *apparatus*. Finally, considered as a whole, they constitute an *organization*.

The organization, which is an intimate union of form and matter, is continually traversed by fluids, whose province is, to convey nourishment to the organs, and to take up, for the purpose of carrying off, what is useless. This twofold movement of composition and decomposition is termed *nutrition*. The first of these two forces, composing nutrition, is called *absorption* ; the second bears the generic name of *secretion*.

Thus the three great functions of nutrition do but prepare and carry off the elements which, as a final result, are absorbed or secreted. Organized beings have been divided into *animate beings*, or such as are possessed of sense and motion ; and *inanimate beings*, or such as are deprived of both these faculties. The power of spontaneous movement in animals requires essential modifications of organization : hence are derived in them the characters of the three great *functions of nutrition*, viz. the *circulation*, the *respiration* and the *digestion*.

CIRCULATION.

A function whose end is the general movement of the blood in the body of animals. This movement consists in carrying the nutritive or arterial blood through all the organs, and in conveying to a respiratory apparatus this same liquid, deprived of the elements of nutrition, and loaded with matter which should be expelled. The circulatory apparatus offers for consideration the heart and the blood vessels.

The Heart.

The principal agent in the impulsion of the blood, placed in man within the cavity of the thorax, between the lungs, the point below, a little forward and to the left. It consists of two sides, which have no communication with each other: the *right side*, which is always filled with venous blood, and in which is the *right auricle*, communicating only with the *right ventricle*; and the *left side*, filled with arterial blood, in which is the *left auricle*, communicating only with the *left ventricle*.

Blood Vessels.

These are of three kinds. The *arteries*, carrying the blood of the heart to the parts. The *veins*, returning it from the parts to the heart. The *capillary* vessels, forming a communication between the veins and the arteries.

Principal Arteries.

These are the *aorta* and *pulmonary artery*. The *aorta*, arising from the base of the left ventricle, terminates at the bottom of the abdomen. It is the common trunk to the *innominata*, the *left carotid* and the *left subclavian*, the *cæliac*, *superior* and *inferior mesenteric*, the *renal* and the *primitive iliacs*. The *right carotid* and *right subclavian* are formed by the division of the *innominata*. The *pulmonary artery*, arising from the base of the right ventricle, is divided into two branches, which lose themselves in the pulmonary tissue.

Principal Veins.

These are the *vena cava superior* and *vena cava inferior*, formed by the union of the principal veins of the body, and terminating, the former at the top and the latter at the base of the *right auricle*; and the *pulmonary veins*, two on each side, extending from the lungs to the *left auricle*.

RESPIRATION.

A function common to all animate beings, and by means of which in animals, the venous blood mixed with the chyle obtains its nutritive properties, under the influence of the oxygen of the atmosphere. The atmosphere surrounds the earth to the extent of from fourteen to fifteen leagues, and is equal in weight to a similar bed of water about thirty-two feet in thickness, or of a like one of mercury about twenty-nine inches thick. This gas is formed of two elements—twenty-one being of oxygen, and seventy-nine of azote in a hundred parts. Vapoury particles of water are also found in the atmosphere, and traces of carbonic acid. This last gas arises from the circumstance that animals, in the act of respiration, convert a certain quantity of oxygen into carbonic acid. It is itself again decomposed by plants, which take to themselves the carbon and give out the oxygen. The respiratory apparatus is composed, in man, of the *thorax*, the *trachea* and the *lungs*.

Thorax.

This is a cavity formed by the *dorsal* portion of the vertebral column behind, by the *sternum* before, and at the sides by the *ribs*, with the *intercostal muscles* filling up the spaces between them; also by a muscle called the *diaphragm*, closing the cavity below, and by means of which its capacity may be increased or diminished.

Trachea,

Or wind pipe, is a cylindrical canal, formed by the *larynx*, whose upper opening is called the *glottis*, and by the *trachea* proper, composed of little cartilaginous rings, connected by membranous partitions. It terminates in the *bronchia*, which are divisions of the *trachea*, leading one into each lung, of which the right is the longer.

Lungs

Are spongy organs, enveloped by *pleuræ*, and formed of the *bronchial divisions* ending in a cul-de-sac among the pulmonary cells, the *ramifications* of the *pulmonary artery* and *veins*, and the *cellular tissue* uniting these different organs so as to form an infinity of small cells.

DIGESTION

A function whose end is to transform the aliment (which is always animal or vegetable matter) into an opaque milky fluid called *chyle*, capable of being absorbed by particular vessels, which pour it more slowly into the circulatory current; where, on mingling with the venous blood, by the influence of respiration, it becomes at length arterial blood. This function may be divided into seven acts:

The taking of Aliment.

In man, by the hands and mouth

Mastication.

The division of the food by means of small and very hard bodies (the teeth), of which some (the incisors) cut, some (the canine) tear, and others (the molars) grind. The teeth are formed of a bony substance, covered with *enamel*, and having within them a cavity containing a vein, artery, nerve and pulpy matter.

Insalivation.

A liquid called *saliva* is imbibed by and softens the divided food. The *salivary glands* are the *parotid*, the *submaxillary*, and the *sublingual*, of each a pair.

Deglutition.

The food reduced to a soft mass crosses the isthmus of the *fauces*, reaches the *pharynx*, passes upon the *glottis*, which is covered by the *epiglottis*, arrives in the *aesophagus* and descends into the *stomach*.

Chymification.

The action of the gastric juice, and the contractions of the stomach, convert the food into a grayish pulp called *chyme*, and propel it into the small intestines.

Chylification.

Under the influence of the bile and pancreatic juice the chyme is now in part converted into an opaque milky liquid called *chyle*. The organs here are the *intestines*, the *liver* and the *pancreas*. The small intestines comprehend the *duodenum*, the *jejunum* and the *ileum*; the large intestine embraces the *cæcum*, the *colon* and the *rectum*.

Absorption of the Chyle.

The *chyle* being absorbed from the internal surface of the small intestines by the *lacteals*, is carried into the *receptaculum chyli*, and thence by the *thoracic duct* into the left *subclavian vein*, which itself opens into the upper *vena cava*. Here the organs are the *lacteals*, the *receptaculum chyli*, and the *thoracic duct*.

FUNCTIONS OF RELATION.

The animal places itself in relation with exterior objects by means of two grand apparatus—the apparatus of sensations and the apparatus of movements. The first of these regards the faculty termed *sensation*, the second the faculty called *locomotion*.

THE NERVOUS SYSTEM

Is formed of a peculiar substance soft and pulpy, nearly fluid in the early period of life, and acquiring more consistency as the animal is developed. This substance, either gray or white, constitutes masses more or less considerable, or cords more or less ramified.

The Nervo-Cerebral System,

Or that of animal life, (Pl. 3, fig. B) includes the *encephalum* and the *nerves*.

The Encephalum. (Pl. 2, fig. A.)

Under the head of *encephalum* we speak of the *cerebrum* (n), the *cerebellum* (r), and the *medulla oblongata* (m, m, m).

The Cerebrum

Is a large pulpy ovoid organ, with the thickest extremity behind. It is composed of two substances; one white and internal, the other gray and usually external; including cavities termed ventricles, and lodged in a bony case called the *skull*. It is the centre of perception. It is divided into two hemispheres, of which each consists of an *anterior*, a *middle* and a *posterior lobe*.

The Cerebellum.

A nervous mass in the hinder part of the skull; gray without, white within; presenting outwardly the appearance of layers folding one over the other.

The Spinal Marrow.

A pulpy cord, white without, gray within; lodged in the vertebral canal; extending from the base of the brain to the lumbar portion of the vertebral column, where it is divided into a great number of filaments called the *cauda equina*, from its fancied resemblance to a horse's tail.

The Nerves.

White cords extending from the base of the brain and from the spinal marrow to the muscles, and to the surface of the general coverings of the body, to form the organs of *sense*. (Pl. 2, fig. A, and Pl. 3, fig. B.)

The Sense of Touch.

Of this the seat is the skin. The skin is composed of the *epidermis* (Pl. 1, fig. 1, b, and Pl. 2, fig. 2, e), the *nervous* and *colouring tissue* (Pl. 1, fig. 1, a, and Pl. 2, fig. 2, d), the *dermis* (Pl. 1, fig. 1, c, and Pl. 2, fig. 2, c), and the piliferous (hair producing) bulbs, and is supplied with blood vessels (Pl. 2, fig. 2, a).

The Sense of Taste.

Of this the instrument is the *tongue*, or rather the mucous membrane covering the tongue.

The Sense of Smell. (Pl. 2, fig. 3.)

The apparatus of smell is composed of the olfactory nerve and pituitary membrane covering the *nasal fossæ*, including the spongy bones, the partition of the nose (*vomer*) and cartilages with the sinuses (fig. 3, a). This sense is excited by the action of odours upon this apparatus.

The Sense of Hearing. (Pl. 2, fig. 4.)

This apparatus is composed of the external ear, including the *pinna* or *pavilion* (a, b, d) and the external auditory canal (c); the middle ear which includes the cavity of the *tympanum* (h) separated from the external ear by the membrane of the *tympanum* (g); the chain of small bones, viz., the *stapes*, the *orbiculare*, the *incus* and the *malleus*; the muscles which move these bones; and the *eustachian tube* (k); the internal ear, embracing the *vestibule*, where we find the oval window, *fenestra ovalis*, the opening of the semicircular canals (l), and the opening of the *cochlea*; the semicircular canals (m); the

cochlea (p); and the auditory nerve (o). This subject embraces the *theory of sound*, including the *nature of sound* and its *mode of transmission*, and the *mechanism of hearing* or the transmission of sound through the different portions of the ear.

The Sense of Sight.

Under this head are comprised the apparatus for its protection (Pl. 3, fig. 5), embracing the *brows*, the *orbit*, the *eyes*, the *eyelashes*, the *lachrymal gland* (k), the *lachrymal points*, the *lachrymal ducts*, and the *nasal duct*—the apparatus of *motion*, consisting of eight muscles, viz., those which move the lids (the *orbiculare* and *levator* of the *upper lid*), and those which move the ball, the *great oblique* (l), the *small oblique* (g), the four straight muscles (f, i and d)—the *globe of the eye* (fig. 6), including the *conjunctiva* (b), the *sclerotic membrane* (s), the *choroid membrane* (ch), the *retina* (r), the *iris* (i), the *pupil* (p), the *cornea* (c and fig. 5, a), the *aqueous humour*, the *cystalline humour* (ca), the *vitreous humour* (o), and the *optic nerve* (n and fig. 5, c)—and finally it includes the subject of *light*, embracing its *nature, direction, reflection, refraction* (fig. 7, 8 and 9) and *decomposition*, together with the *mechanism of vision*, or the progress of the luminous rays into the eye (fig. 10).

The Nervous System of Organic Life,

Or the *great sympathetic*, is composed of ganglions, united among themselves by nervous cords, and forming a double chain on both sides of the vertebral column, extending from the head to the pelvis.

This nervous system presides over the organs of involuntary motion, such as the heart, the stomach and the intestines.

LOCOMOTION.

Animals are not only capable of receiving impressions from external objects; they can likewise avoid or approach these objects at will. This faculty is termed the faculty of *locomotion*. It is effected by means of two apparatus, one active (the muscular apparatus), the other passive (the bony apparatus). There is another faculty besides that of sensation and of locomotion, which completes the life of *relation*; it is the power enjoyed by a great number of animals of

making known their ideas among themselves by articulate sounds or by cries.

This faculty is called the *voice*, and its apparatus the vocal apparatus, or

Larynx.

The *larynx* is attached above to a bone called the *os hyoides* and below to the *trachea*. Its sides are formed by five cartilages, and supplied with muscles by which a limited degree of motion is effected: its superior opening is called the *glottis*, over which is a fibro-cartilaginous substance named *epiglottis* placed at the base of the tongue.

The Muscular Apparatus.

“Muscle” is the term applied to certain fleshy organs composed of fibres of extreme tenuity, which are straight and arranged in a parallel manner among themselves.

These organs are endowed with contractility; that is to say, with the power of shortening and extending themselves alternately. In the motions of contraction the fibres fold up in a zigzag form, and the muscle becomes hard and swollen. The power of the muscles does not act directly on the bones, but through the agency of certain whitish, fibrous prolongations, denominated when thick, *tendons*, and when spread out, *aponeuroses*.

Muscular contractions operate, some under the influence of the will (and in this case the muscles receive nerves from the *cerebro-spinal system*); others again are produced without any agency on the part of this faculty, and in this case the muscles receive their nerves from the great *sympathetic*; others, finally, are produced by the united influence of both the nervous systems.

The Bony Apparatus. (The Skeleton.)

Skeleton is the name applied to the whole collection of bones in the superior animals. Its use is to afford a base of support to the soft parts, and to furnish the muscular powers with resisting levers, which give energy, extent and precision to the motions. The bones are the hardest portions of the bodies of animals. Bones are formed of two principal substances; the one an animal substance (gelatine), inter-

mixed with an earthy matter (phosphate of lime). Their structure is varied, being, in the long bones, compact in the middle, with a central cavity, and the extremities spongy; while in the flat bones it is lamellated on the external surface, but the internal substance is cellular. The bones are divided, according to their form, into *long*, *flat* and *thick*. The first are found in the limbs, the second about cavities, the third wherever mobility and solidity are to be united.

The bones are connected among themselves by approximation, without any intervening substance forming *sutures*, by cartilaginous substance, by tendinous bands (*ligaments*), in the movable articulations enclosing a cavity in the form of a sac: these are termed *capsular ligaments*.

The place of union in bones is called *articulation*; of this there are two kinds, *movable* and *immovable*; upon the surfaces of bones articulated in the former manner certain resisting substances are found resembling a kind of animal pasteboard; these are denominated *cartilages*. A liquid called *synovia* moistens them and facilitates their movements.

The Head

Comprehends the *cranium* and *face*. The cranium or skull consists of eight bones, which form a cavity for containing the brain. These bones, which are flat, are the *frontal* before; the *occipital* behind and below; the *parietal* at the sides and above; the *temporal* at the sides and below; the *sphenoid* before and below; and the *ethemoid* in the anterior part of the base of the *cranium*. The *face* consists of the upper and lower *maxillæ* or jaws; the *upper jaw* contains six pair of bones, and one single bone, and sixteen teeth. These are the two *superior maxillary*, the two *nasal*, the two *ossa unguis*, the two *molar*, the two *palate*, the two *spongy* bones, and the *vomer*, which last forms the partition of the nose.

The *lower jaw* has but one bone besides the teeth; it is the *inferior maxillary* bone.

The Trunk

Consists of the *spine*, the *thorax* and the *pelvis*.

The Spine

Is composed of the *true* and *false vertebræ*. The true *vertebræ* comprise three classes. First, the *cervical*, which are the seven uppermost *vertebræ* belonging to the neck; the first is called the *atlas*, the second the *dentata*. Second class, the *dorsal* or those of the back, which are twelve in number. And the third, the *lumbar*, or those of the *loins*, five in number.

The Thorax

Is composed of the *dorsal vertebræ*, twelve pair of *ribs*, with their cartilages, and the *sternum*.

The Pelvis

Is composed of the *false vertebræ* (the *sacrum* and *coccyx*) behind, and the two *ossa innominata* at the side and in front.

The Members

Comprise the two extremities; the *superior* and *inferior* extremity.

The Superior Extremities,

Each, consist of the *shoulder*, the *arm*, the *fore-arm* and *hand*.

The Shoulder

Is composed of two bones; the *clavicle* or *collar bone*, a long bone, in front; the *scapula* or shoulder blade, a flat bone behind.

The Arm

Has one long bone, the *humerus*.

The Fore Arm

Has two long bones, the *radius* and *ulna*.

The Hand

Comprehends the whole structure from the end of the fore arm to the points of the fingers. It consists of the *carpus* or wrist, the *metacarpus* or parts near the wrist, and the *fingers* including the thumb.

The Carpus

Is composed of eight small bones arranged in two rows.

The Metacarpus

Of four bones which sustain the fingers.

The Fingers,

Each, of three bones, called *phalanges*.

The Inferior Extremities,

Each, consist of the *thigh, leg and foot*.

The Thigh

Has one long bone, the *femur*.

The Leg

Has two long bones, the *tibia* and *fibula*, with a thick bone, the *patella*, which is connected with it and the thigh, forming the anterior part of the knee joint.

The Foot

Is divided into the *tarsus, metatarsus* and *toes*.

The Tarsus

Consists of seven spongy bones.

The Metatarsus,

Of five bones sustaining the toes.

The Toes,

Of three bones each; except the great toe, which has but two bones.

VARIETIES OF THE HUMAN RACE.

*Distribution of the Human Races on the Face of the Globe,
according to the Animal Kingdom of Cuvier.*

THE order of the BIMANA, easily distinguished by the existence of hands at the anterior extremities only, and by the presence of three kinds of teeth, is composed of but one genus, embracing but one species. Man is the only mammiferous animal truly *biped*. His feet, likewise, afford a base of support larger than in any other animal. The great width of the pelvis, by separating the thighs and feet, gives the body a pyramidal form very favourable to equilibrium. The head is also naturally in equilibrium in the vertical position; but even if he wished, man could not walk on all fours. The foot is too short and almost inflexible, and the thigh being too long would bring the knee towards the ground. The fore limbs, being too wide apart, and too weak, and shorter than the hinder ones, would be obliged to support the enormous weight of the head and chest, and even part of that of the pelvis. The want of a cervical ligament and the little subdivision among the arteries which lead to the brain would subject him to frequent apoplexies. Moreover in this position he would lose that activity and delicacy of touch which is so valuable—touch the most exact instrument which intelligence employs. His eyes would be continually turned towards the earth, and the nostrils to the rear. On the contrary, in the biped position man resumes all his advantages. Nevertheless, if we examine him as an isolated being and simply in a physical view, he will appear to us the most unfortunate of animals. He has neither offensive nor defensive weapon; his naked skin is exposed as well to the burning heat of the sun as to the rigorous cold of winter. What

is his strength before that of the lion? or the rapidity of his pace compared with that of the horse? Has he the flight of the bird? an equal power of swimming with the fish? the dog's sense of smell? the piercing eye of the eagle? or the hearing of the hare? What is his size beside that of the elephant? To escape his enemies he has not even the imbricated shells of the pangolin, nor the buckler of the armadillo. But, if we consider his admirable intelligence, we behold him subjecting to his dominion or employing in his service the rapidity of the horse, the strength of the elephant, the smell of the dog, the piercing eye of the eagle. By means of this intelligence he alone, of all other beings, has been enabled to form for himself a language. Through this, fathers transmit to their children their experience, their ideas; and this heritage, in passing from generation to generation, always increased in its progress from the preceding generation, becomes at length a treasure which the memory is no longer capable of preserving. This accumulation upon accumulation of facts gave birth to writing and then again to printing, the province of both which is, to render language perceptible by the eye in all places and at all times.

CAUCASIAN VARIETY.

Facial angle from eighty-six to ninety degrees. Face oval; forehead prominent; eyes horizontal; the balls but slightly projecting; colour of the skin white or at least whitish; hair varying from black to a shade nearly white. This variety has formed all the most civilized people of the earth. It occupies Europe (with the exception of the polar regions), western Asia and the northern part of Africa. It is believed to have had its origin in the groups of the Caucasus. Three branches.

THE GERMANIC-INDO-PELASGIAN BRANCH.

Germans.

Facial angle about ninety degrees. The vertex rounded; face nobly oval; forehead open; nose straight or nearly so; eyebrows more or less arched, reigning over large eyes. Lips agreeably coloured and never too thick. Ears small and lying close to the head. Beard well furnished. Hair

smooth, generally fine, often curly, varying from black to nearly white. [Western part of Europe.]

Pelasgians.

Oval of the face a little more elongated than in the preceding. Nose perfectly straight and extending from the forehead without any depression to the height of the eyes, which are exceedingly large. Hair fine, brown or chestnut, rarely light, remarkable for its excessive length. Complexion white, but a little embrowned. Stature about five feet and ten inches. [Eastern and meridional parts of Europe.]

Hindoos.

Complexion of a deep yellow, inclining to bronze. Nose somewhat agreeably rounded, without ever being flat; lips thin; eyes round, and tolerably large, with the iris black; hair long, flat and always very black and glossy; beard not well furnished; disposition mild, simple, docile, industrious, neither lethargic nor active; sobriety remarkable. Agricultural or sedentary, they leave the commerce of their rich country to Europeans or to Arabs.

THE ARABIAN BRANCH.

Face oval, and much elongated at the two extremities; chin pointed; forehead large and prolonged to an elevated summit. This character of the head is perhaps the cause of that religious enthusiasm which prevails among the people of this branch. Nose well defined, thin, pointed and aquiline; eyes black, large, and surmounted with arched and thick eyebrows; lips thin; mouth agreeable; hair black, very long, never curling; skin soft, fine, smooth and tawny—often deeply so. The Arabs have quick intellect, an aptitude for science, cunning and the virtue of hospitality. On the other hand they are avaricious and great robbers. Their language is emphatic and full of poetic imagery.

THE SCYTHIAN BRANCH.

Upper part of the face excessively wide and flattened; eyes very small, deep set, so far apart that there is often more than the breadth of the hand between them, and surmounted by large rough eyebrows; nose very broad and flat; eyeballs excessively prominent; chin pointed; beard tolerably furn-

ished, especially about the lip, and brown approaching to red ; Hair flat, usually black ; body robust and muscular ; legs short ; knees turning outwards ; feet inwards. Wanderers, indomitable hunters, shepherds, but never agriculturists. Having no local attachments, they emigrate in innumerable bands, and, at different epochs, spread themselves like a flood to the north, south or west.

MONGOLIAN VARIETY.

Face flat; forehead square and oblique; eyeballs projecting; eyes narrow and oblique; chin slightly projecting; beard thin; hair straight and black; skin more or less yellow or olive; language monosyllabic. [Asia beyond the Ganges.]

Chinese.

Face round and widened in the middle; cheek bones projecting; eyes almond shape when open, with the external angle very high; lids large and nearly destitute of lashes; brows very thin and black; nose well separated from the forehead by a deep depression, rounded, slightly flattened, with the nostrils somewhat expanded; mouth large, with vertical teeth; lips thick and of a livid red; chin small and unfurnished with beard; hair smooth, flat, never curling, of moderate length, thick and always black; skin oily, and sometimes of a deep brown. Mild, civil, flatterers, cringing, brokers and greedy of gain. They are essentially rice eaters.

Malays.

Complexion maroon colour, approaching to brick-red or yellow; eyes less elevated towards the temples; eye-balls less projecting than among the Chinese. [The coast of Indo-China, all the Asiatic Archipelago and the ocean as far as Madagascar.]

Hyperborean Regions of the two Continents.

Head round and of huge dimensions; face wide, short and flat in front; nose flattened; eye-lids drawn up towards the temples; mouth large; teeth vertical; hair smooth, black, naturally greasy and hard; beard thin; ordinary height about five feet; skin tawny and even entirely black, ac-

cording to the countries in which they dwell. They have domesticated the reindeer as well as the dog. They live upon the flesh of these animals, upon the blubber of whales, and upon a kind of bread made of bones, lichens and the pounded bark of the birch tree.

ETHIOPIAN VARIETY.

Skull compressed; nose flattened; muzzle projecting; facial angle acute; lips thick; hair more or less frizzled; skin more or less black.

Negroes.

Hair woolly; skull compressed, and forehead depressed; nose flat; incisive teeth projecting; skin black. [Africa from the Senegal and the Niger to beyond the southern tropic.]

Negroes of Mozambique.

Hair woolly; skin black; skull less compressed than among the Ethiopians; forehead almost as projecting as among Europeans; incisive teeth vertical; nose but little flattened. [Eastern side of Africa upon the Indian ocean.]

Papous.

Hair very thick, and moderately woolly; forehead high; nose a little flattened; face tolerably regular. [Coast of New Guinea.]

Alfourous.

Hair smooth and black; beard thin; skin black; limbs slender, and of a length disproportioned to the body; nose much widened; forehead depressed and compressed. [Interior of New Guinea and of New Holland.]

Hottentots.

Facial angle seventy-five degrees; hair black or brownish, very short and woolly; teeth oblique and bent; the olecranous cavity of the shoulder having a hole in it; skin more or less yellow, never black; nose immoderately large; top of the head flattened; and of a disgusting filthiness. Unsocial, taciturn and fearful, they live in caverns, and hardly know the use of fire.

PEOPLE OF AMERICA WHO CANNOT BE REFERRED TO ANY VARIETY.

North Americans.

Head elongated ; nose long, projecting and very aquiline ; forehead compressed and flattened ; complexion a copper red in all climates ; hair black ; beard thin ; moral character energetic. [All North America ; all the plains and declivities of the Cordilleras from Chili to Cumana and the Caribbean Archipelago, inclusively.]

South Americans.

Head generally spherical ; forehead wide but depressed, as among the Mongolians ; eyebrows elevated towards the temples ; eye-balls projecting ; nose flattened and depressed at the root ; hair long, coarse and straight ; skin neither yellow, nor black, nor copper ; lips very thick ; intellect generally obtuse ; moral character altogether brutal.

CLASSIFICATION.

GENERAL distribution of the Animal Kingdom into Four Great Divisions.

First Great Division. Animalia Vertebrata—Vertebrated Animals.

The interior skeleton forming the solid frame-work of the body. Nervous system composed, besides the ganglions and the nerves, of a brain and a spinal marrow situated above the digestive tube and inclosed in the cavity of the cranium and the vertebral canal. Blood red; heart muscular, with at least two cavities. Respiration generally aerial and pulmonary; sometimes aquatic, being effected by means of branchiæ. Mouth with two jaws placed one above or at least before the other. Organs of sense to the number of five, and distinct; four are lodged in the cavities of the head. Form of the body symmetrical; never more than two pairs of limbs.

Subdivision of the Vertebrata into Four Classes.

FIRST CLASS. MAMMALIA.

Viviparous; having mammæ and hair; blood warm; circulation double and complete; heart with four cavities; respiration pulmonary, and simple.

SECOND CLASS. BIRDS.

Oviparous; having feathers; blood warm; circulation double and complete; heart with four cavities; respiration pulmonary, and double.

THIRD CLASS. REPTILES.

Oviparous; skin naked or furnished with scales; blood

• cold; circulation double and incomplete; heart with three cavities; respiration pulmonary, and simple.

FOURTH CLASS. FISH.

Oviparous; skin naked or furnished with scales; blood cold; circulation double and complete; heart with two cavities; respiration aquatic, by branchiæ.

Second Great Division. *Animalia Mollusca*—Molluscous or Soft Animals.

Neither interior nor exterior skeleton; body enveloped in a soft and contractile skin to which the muscles are attached. This skin, in many species, encrusts itself with stony matter forming a kind of plate denominated *shell*. Nervous system composed of many scattered masses, joined by nervous threads, the chief of which is placed upon the œsophagus, and have the name of *brain*. No special organ for smell, very seldom for hearing, and often none for sight. Circulation complete; blood white; generally a bluish white. Respiration effected sometimes in a kind of pulmonary cavities; more often by branchiæ. Seldom members for locomotion.

Division of Mollusca into Three Classes.

FIRST CLASS. CEPHALOPODA.

Head very distinct, surmounted with fleshy arms, flexible in every direction, and serving either for progress or for the seizure of an object; the rest of the body inclosed in a rounded sack. Circulation double; respiration by branchiæ.

SECOND CLASS. GASTEROPODA.

A fleshy disk, upon which they crawl, is placed under the abdomen. Head more or less distinct, provided with one or more pairs of tentacula or feelers; respiration pulmonary or branchial.

THIRD CLASS. ACEPHALA.

No distinct head nor feelers; mouth concealed with the body in a mantle which is divided into two lobes.

Third Great Division. Animalia Articulata—Articulated Animals.

The interior skeleton replaced by an external one formed of a skin more or less modified in its nature and consistence, and composed of a series of rings, movable one upon another. Nervous system consisting in two long cords extending through the length of the abdomen, and dilated at certain distances into knots or ganglions. The first of the knots placed above the oesophagus, and called *brain*, communicates by threads, which form a collar to the oesophagus, with those placed beneath the abdomen; blood white except in the Annulata. There is a rapid decline in the circulation from the first animals of this division to the last, where we may say indeed that it does not exist or is performed by simple imbibition. At least three pairs of limbs when they exist at all.

FIRST CLASS. ANNULATA.

Blood red; circulation complete; body covered with a soft skin, and divided into numerous rings; respiration by branchiæ; no articulated limbs; no metamorphoses.

SECOND CLASS. CRUSTACEA.

Colourless blood contained in two kinds of vessels; skin encrusted with carbonate and phosphate of lime; head confounded with the thorax; four antennæ or feelers; two compound eyes; foot jaws; always at least six articulated feet; respiration by branchiæ; no metamorphoses.

THIRD CLASS. ARACHNIDES.

Blood colourless; two systems of vessels in those which respire by lungs; circulation as in insects in all which respire by tracheæ; head confounded with the thorax; eyes simple; more than three pairs of limbs; no metamorphoses.

FOURTH CLASS. INSECTS.

Blood colourless; distributing itself to the different parts of the body by simple imbibition; body presenting three parts—head, thorax and abdomen; generally three pairs of limbs; respiration by tracheæ; metamorphoses more or less complete.

Fourth Great Division. Animalia Radiata—Radiated Animals or Zoophytes.

A symmetry in the disposition of the organs of motion and of the senses, which are placed in rays around a centre; opposite faces of the body similar; no distinct nervous system, nor organs of sense; respiratory organs situated upon the surface of the body; circulation hardly discoverable in the greater number; a sac without issue for intestines.

Division of Zoophytes into Four Classes.

FIRST CLASS. ECHINODERMATA.

Body invested with a well formed skin; having a sort of skeleton armed with points or movable spines; an internal cavity and a sort of vascular system, with distinct organs of respiration.

SECOND CLASS. ENTOZOA OR INTESTINAL WORMS.

Body in general elongated; no tracheæ, branchiæ nor other respiratory organ; no trace of true circulation; some vestiges of nerves.

THIRD CLASS. POLYPI.

A small gelatinous body, often without other organ than a cavity; mouth surrounded with tentaculæ; propagation of new individuals by shoots and eggs.

FOURTH CLASS. INFUSORIA.

Little microscopic beings swarming in stagnant waters; chiefly gelatinous, and without viscera.

MAMMALIA.

ORDER II. QUADRUMANA.*

Resemblance to Man greater than in any other animals; hands to the inferior as well as to the superior extremities; the three kinds of teeth, incisive, canine and molar; eyes directed to the front, or at least obliquely; mammae upon the breast; each hemisphere of the brain composed of three lobes, of which the posterior covers the cerebellum; intestines like those of man; climbing, fructivorous animals. In consequence of this family having the toes of the hind feet free and opposable to the others, they climb trees with the greatest facility, while it is only with pain and difficulty they can stand or walk upright; their foot then resting on its outward edge only, and their narrow pelvis being unfavourable to an equilibrium. Three families.

FAMILY I. SIMIA, LIN. MONKEYS PROPER.

Four vertical incisive teeth in each jaw; molars with blunt tubercles; the nails of the fingers flattened, and all of the same form, with the exception of the genus *Ouistitis*; size diminutive or middling; skull almost always rounded; muzzle somewhat prolonged; neck short; body slender; limbs slim and long; hair close, long and silky; the four straight incisors in each jaw, and the flat nails on all the extremities, are characteristics which approximate the monkeys more nearly to man than the subsequent families. Two tribes.

TRIBE I. MONKEYS OF THE OLD CONTINENT.

Five molar teeth on each side and on each jaw; nostrils open beneath the nose, and separated by a narrow partition;

* Having four hands.

almost always a callus on the seat and cheek pouches; tail never prehensile (clinging). Six remarkable genera.

GENUS I. PITHECUS, Geoff. Ourangs.

No tail, nor callosities, nor cheek-pouches. Of all animals the ourang is considered as approaching most nearly to man in the form of his head, height of forehead and volume of brain; but many exaggerated descriptions of this resemblance have arisen, no doubt, from the fact that young individuals only were seen. There is every reason to believe that with age the likeness decreases as the muzzle becomes more prominent. The body of the Ourang-Outang is covered with coarse red hair, the face bluish, and the hinder thumbs very short compared with the toes. [Cochin-China, Malacca, Borneo.]

GENUS II. HILOBATES, Illig. Gibbons.

A callus on the seat; arms very long; neither tail nor cheek pouches. [The Indies and their Archipelago.]

GENUS III. CERCOPITHECUS, Erxl. Monkeys Proper.

Tail long; limbs elongated; form slender; head rounded; muzzle moderately projecting; large cheek-pouches; callosities; size middling. The length of the hinder limbs gives these animals great facility in leaping. They abound in Africa, live in troops, and do much damage to gardens and fields under cultivation. They are easily tamed.

GENUS IV. SEMnopithecus.

Muzzle as in the Gibbons; length of the limbs disproportionate; tail very long; callosities; no cheek pouches; the larynx furnished with a sac. They differ from the long tailed Monkeys by having an additional small tubercle on the last of the inferior molars. [Eastern part of Asia.]

GENUS V. INUUS, Cuv. Magots.

Cheek pouches; callosities; a simple tubercle supplying the place of tail; completely covered with a light brown hair. "Of all Monkeys it is the one that suffers the least from our climate," says Cuvier. He is originally from Barbary, but is said to have become naturalized in the most inaccessible parts of the rock of Gibraltar.

GENUS VI. CYNOCEPHALUS.*

Teeth very strong ; false cheeks ; callosities ; muzzle elongated, and, as it were, cut off at the end where the nostrils are pierced, which causes it to resemble that of the Dog ; large size ; brutal and ferocious disposition. Our engraving represents the dog-faced Baboon of Pennant, or Moco-Ape of Buffon. A bluish ash colour ; hairs of the ruff, and especially those of the sides of the head, very long ; face flesh coloured ; of a horribly vicious instinct. [Arabia and Ethiopia.]

TRIBE II. MONKEYS OF THE NEW CONTINENT.

Six molar teeth on each side, and in each jaw ; no callosities nor false cheeks ; nostrils in the side of the nose ; tail long, frequently prehensile—that is, the extremity is capable of seizing a body with much force by twining round it. Two sections.

Section I. *Cebus, Erxl. Sapajous.*

The tail prehensile.

GENUS MYCETES, Illig. *Howling Monkey.*

Head pyramidal ; face oblique ; lower jaw extremely large ; the hyoid bone has a swelling or bony drum, which communicates with the larynx, and gives to the voice of these animals an enormous volume and frightful sound.

Section II. *Pithecia, Desm., Illig. Sakis.*

Tail not prehensile.

FAMILY II. OUISTITIS.

Incisive teeth to the number of four in each jaw, but oblique and bent, especially in the upper jaw ; twenty molar teeth ; no callosities nor cheek pouches ; tail bushy and not prehensile ; nails compressed, crooked and sharp like claws ; thumbs of the forehands movable, but placed with difficulty in opposition to the fingers, from which, indeed, they are so slightly separated that it is with hesitation we assign to them the name of Quadrumania. They are pretty little creatures, of agreeable forms and easily tamed. [South America.]

Dog-headed.

FAMILY III. LEMUR, LIN. MAKIS.

The incisive teeth in greater number, or otherwise directed, than among the Monkeys; fore-thumbs easily opposed to the fingers; nails flat, except those of the first or two first hind fingers, where they are pointed and raised; nostrils in the end of the snout and winding; their fur is woolly, and their teeth begin to exhibit sharp tubercles catching in each other as in the Insectivora. The Lemur, or Maki, properly so called, is a very active animal, and, from its pointed head, is sometimes called the fox-nosed Monkey. This species is very numerous, and only met with in the island of Madagascar.

ORDER III. CARNARIA.*

Unguiculated animals, with thumbs not opposable, having the three kinds of teeth, and being born in the ordinary manner; jaws usually short, with the articulation transversely directed, and hinge-like, so as to admit of no lateral movement; the muscles which move these parts are extremely vigorous; shape, acuteness and number of the teeth according to the aliment, which is composed more or less exclusively of prey; length of the intestines inconsiderable, and in relation also with the instinct, whether more or less sanguinary, of these animals; sense of smell more fully developed than any other sense. A numerous order, including many curious animals; consists of three families, of which Plate 7 presents only the two first.

FAMILY I. CHEIROPTERA.

The character of this family is distinguished by a kind of wings formed by a fold of the skin, which commences at the sides of the neck and extends between the fore feet and toes, enabling them to fly, which, to give the necessary rotation of the arm, requires them to be furnished with complete clavi-

* Flesh-eating.

cles and large scapulæ; four canini; incisors varying in number; pectoral mammæ. Four tribes.

TRIBE I. *VESPERTILIO*, LIN. BATS.

Fingers of the anterior limbs excessively long, and forming, with the membranes which they sustain, wings as well developed as in Birds; pectoral muscles very thick; thumb short and armed with a crooked nail, which these animals use in suspending themselves or in creeping; hind feet weak and divided into five equal fingers, armed with trenchant claws; eyes very small; touch very delicate, having its seat in the skin of the ears and the wings; nocturnal animals, passing the winter in lethargy.

Group I. Fructivorous Bats.

GENUS *PLEROPUS*, Briss.

Molar teeth with flat crowns; the second finger before armed with a nail like the thumb.

Group II. True or Insectivorous Bats.

Molar teeth studded with conical points, fitting into each other so as to break the horny shells of insects, and to prevent the escape of so small a prey; no nail on the second finger. Four remarkable kinds.

GENUS I. *VESPERTILIO*, Geoff. and Cuv.

Ears separated and of moderate size; nose without appendage; tail comprised in the membrane. Common Bat; Serotine; Pipistrell.

GENUS II. *MEGADERMA*, Geoff. *Oreillard.*

Ears larger than the head, and joined to each other.

GENUS III. *RHINOLOPHUS*, Geoff. and Cuv.

Nose furnished with membranes and with crests, presenting the rude figure of a horse shoe.

GENUS IV. *PHYLLOSTOMA*, Geoff. and Cuv.

Membrane in the form of a leaf folded up upon the end of the nose; tongue extensible, terminated by papillæ, which appear to form an organ of suction. Vampire; Javelin Bat.

TRIBE II. GALEOPITHECUS.

Fingers of the anterior limbs all furnished with trenchant claws, and not longer than those of the posterior limbs; so that the lateral membrane performs only the office of a species of parachute; live upon trees, where they leap from branch to branch; insectivorous. [Indian Archipelago.]

FAMILY II. INSECTIVORA.

No wings nor parachute, but clavicles like the first family. Molar teeth studded with little conical points, in accordance with their insectivorous habits; some have long incisors in front; others incisors and canini shorter than the molars; mammae placed under the abdomen; size small; life nocturnal; habitation, during the day, in holes and burrows. In cold climates many of them pass the winter in a torpid state.

GENUS I. ERINACEUS,^{*} Lin. *Hedgehog.*

Spines instead of hairs; the skin of the back is furnished with such muscles, that the animal, by inclining the head and feet towards the abdomen, can shut itself up as in a purse, and present his spines on all sides to an enemy; habitation in the woods; life nocturnal.

GENUS II. SOREX, Lin. *Shrew.*

Body small, covered with hair; muzzle sharply pointed; ears short and rounded; upon each flank a band of stiff setæ, from which issues an odorous humour; habitation in holes excavated in the earth; life nocturnal.

GENUS III. TALPA. *Mole.*

Type of digging, subterranean animals; body thick and short; muzzle elongated and terminated by a movable snout, serving to pierce the earth; anterior limbs very short, very strong, wide, with united fingers to the number of five, and armed with trenchant claws proper for digging. Hind feet weak, and with five fingers; tail rather short; eye small and concealed by hair; no external ear.

FAMILY III. CARNIVORA.

Four thick and long canine teeth; six incisives in each jaw, the root of the second of the lower ones being placed a little more inwards than the others; the molars are entirely trencrant or have blunted tuberculous parts, but never bristled with conical points. The anterior molars are the most trencrant, they are called *false molars*; next comes a molar larger than the others and which has generally a tuberculous heel more or less wide, it is called *carnivorous*; then follow one or two small teeth perfectly flat, and denominated *tuberculous*. These animals are more or less carnivorous in proportion to the quantity of the tuberculous surfaces, the acuteness of the false molars and the length of the canine. Those genera having the fewest false molars and shortest jaws are best adapted for biting; upon these differences they are most satisfactorily established. Three tribes.

TRIBE I. PLANTIGRADA.

Animals walking upon the entire sole of the foot, and having no hair upon this part; five fingers on all the feet. In the slowness of their movements and in their nocturnal habits they resemble the Insectivora, and, like them, want the cæcum. The greater number of those who inhabit cold countries pass the winter in a torpid state. Three remarkable genera.

GENUS I. URSSUS, Lin. Bear.

A variable number of very small false molars behind the carnivorous teeth; three large molars on each side of each jaw, entirely tuberculous; canines rounded and very large; body stout; limbs thick; tail very short. These Mammalia possess great prudence, and are less formidable than is ordinarily supposed. Nearly fructivorous, or at least omnivorous, by their dental system, they prefer fruits to flesh; and it is only when pressed by famine, that they attack other animals. They are found in all regions of the globe; their fur and their fat cause them to be actively pursued; the chase, however, is not without danger, on account of their obstinate courage and their great strength. There are countries, notwithstanding, where the people make no scruple of attacking them, without other

weapon than a stake which they endeavour to force into the stomach, profiting by the moment when they rear upon their hind legs the better to wrestle with their enemy, and to stifle him in their embrace, according to their usual fashion. Their flesh is much esteemed, and their paws are considered a delicacy. *U. Arctos*; *U. Americanus*; *U. Labiatus*; *U. Maritimus*.

GENUS II. PROCYON, Storr. *Racoons.*

Canine teeth straight, three false molars pointed; three tuberculous molars behind, on each side. Tail, long, resembles the Bear's. Inhabit North America and South America.

GENUS III. MELES, Storr. *Badger.*

These sad and timid animals inhabit the temperate regions of Europe and of Asia, and dig for themselves, by means of their claws, winding tunnels beneath the earth, which they furnish with dry grass. They come out only at night in search of their food, which consists of rabbits, field mice and lizards. When pressed by hunger they content themselves with roots and fruits. Only one species is known, which is actively pursued for its fur which furnishes a stiff hair suitable for shaving brushes. When attacked, it throws itself upon its back, and presents to its enemy its four feet, combating with desperate resolution, and seldom dies unrevenged. Have a small tooth behind the canine followed by two pointed molars; then comes in the upper jaw a carnivorous tooth behind, which is a large square tuberculous one. Tail short; claws of forefeet long, and a peculiar sac under the tail exuding a fetid humour. Skin of its abdomen at least as thick as that of its back.

TRIBE II. DIGITIGRADA.

Animals walking upon the extremity of the toes, lifting the tarsus. Three groups, of which Plate 9 includes only the two first.

Group I.

Only one tuberculous tooth behind the upper carnivorous; body very long; limbs short, permitting them to pass through the narrowest openings; they have hence been called vermi-

form; small and weak, they are nevertheless very cruel, and live on blood; they do not become torpid in winter. Four remarkable genera.

GENUS I. *PUTORIUS*, Cuv. *Pole-Cat.*

Head rounded; muzzle short and extending beyond the mouth; ears round and much wider than high; tongue covered with pimples; as many as five toes on all the feet, and united in three fourths of their length by a loose membrane; smell detestable; life nocturnal and solitary; disposition more cruel than in any other kind.

The common Pole-cat is brown, approaching to black; the sides of a reddish yellow; fifteen or eighteen inches long, without counting the tail which is six; it is the terror of hen-roosts and warrens; it will crush the heads of all the fowls in a poultry yard, and transport them one by one to its den. If, as often happens, it cannot carry them off entire, on account of the narrowness of the hole through which it entered, it devours the brains and carries off the heads.

GENUS II. *MEPHITIS*, Cuv. *Skunk.*

Two false molars above, three below, the superior tuberculous one very large; anterior nails long and fitted for digging; remarkable for their fetid exhalations. [America and Java.]

GENUS III. *MUSTELA*. *Marten.*

Great resemblance to the Pole-cat; muzzle, however, more elongated; has an additional false molar above and below; tongue covered with soft pimples. [Both continents.]

GENUS IV. *LUTRA*. *Otter.*

Head large and compressed; body slim; tongue demasperate; on all the feet toes to the number of five, armed with short claws, united throughout their whole length by a broad and strong membrane, which, together with the extreme shortness of their limbs, and their horizontally flattened tail, gives them facility in swimming; fur very thick and composed of two sorts of hair, one silky, long, glossy and thicker at the point than at the base, the other woolly, shorter and more abundant. They live on fish.

Group II.

Two flat tuberculous teeth behind the superior carnivorous tooth, which is itself furnished with a large heel. They are carnivorous, but do not exhibit a courage proportioned to their size and strength; they frequently feed on carrion. Two genera.

GENUS I. CANUS, Lin. Dog.

Three false molars above, four below; two tuberculous teeth behind each of the carnivorous; the first upper tuberculous tooth very large; a small tubercle upon the upper carnivorous; a very large one upon the under; tongue soft; five toes to the fore and four to the hind foot; claws for digging; sight excellent; hearing acute; smell of an astonishing delicacy; diet half vegetable, half animal; a depraved taste for carrion; size middling; proportions of the body betokening strength and agility. Two subdivisions.

Subdivision I. Dog properly so called.

Head oblong, covered with hairs shorter than those of the rest of the body; tail little tufted; pupil of the eye round during the day; upper incisives presenting three festoons. The different races of the domestic Dog are useful allies to Man, faithful friends, who alone, of all other animals, have followed him throughout the world. Some naturalists suppose the Dog to be a Wolf or domesticated Jackal.

Subdivision II. Fox.

Head broader; muzzle more pointed; upper incisors straight; tail longer and more tufted than in Dogs; fissure of the pupil vertical during the day; odour fetid.

GENUS II. VIVERRA. Civet.

Three false molars above, four below, the anterior of which sometimes fall out; two pretty large tuberculous teeth above, only one below; tongue bristled with sharp and rough papillæ; claws more or less retractile. They often emit an agreeable perfume. Three remarkable subdivisions.

SUBGENUS I. VIVERRA, Cuv. Civets, properly so called.

A deep pouch divided into two sacs, filled with a pomade of a strong musky smell; pupil of the eye round during the day; claws semi-retractile.

SUBGENUS II. GENETTA, Cuv. *Genets.*

Odoriferous pouch reduced to a slight depression formed by the projection of the glands, and without any sensible excretion ; claws retractile.

SUBGENUS III. MANGUSTA, Cuv. *Mangouste.*

Pouch voluminous, simple and containing no odorous matter ; claws semi-retractile. The Egyptian Mangouste is celebrated under the title of Ichneumon. It has a long tail terminated with a black tuft. It is larger than our Cat and as slender as a Marten. By the Europeans, at Cairo, it is called *Pharaoh's rat*, but by the natives *nemus*. There is no foundation for the classical tradition respecting its practice of jumping down the throat of the Crocodile. It devours its eggs, however, with avidity.

Group III.

No small teeth behind the carnivorous tooth of the lower jaw ; carnivorous instinct more fully developed than in all the other Carnaria. Two genera.

GENUS I. HYENA, Storr.

Three false molars above, four below, remarkably large, capable of breaking the bones of the strongest prey ; tongue rough ; four toes on all the feet, armed with huge trenchant claws ; sense of smell delicate ; tail short and pendent ; a deep glandular pouch secreting a matter of disagreeable odour ; fur rough, sparse, composed of long hair, forming a crest upon the back ; gait peculiar, on account of the body being lower behind than before ; life nocturnal ; habitation in caverns ; a depraved appetite for dead bodies, which it will seek even in the grave.

GENUS II. FELIS, Lin. *Cat.*

Muzzle short and round ; jaws possessing the greatest power known on account of their shortness, and the muscular masses destined to move them ; only one small tuberculous tooth behind the upper carnivorous, without any corresponding one below ; two false molars above and below ; enormous canine teeth adjoining the incisives, and more than twice their length ; five toes before and four behind, all armed with retractile claws, which, being raised perpendicularly, and

entirely concealed among the toes while in repose, by means of elastic ligaments, lose neither their point nor edge; sense of smell less acute than among the Dogs; tongue hard and bristled with horny papillæ, serving to rasp the soft portions of their prey; hearing well developed; sight excellent; opening of the pupil round or vertical according to the mode of life. They are formidable animals, capable of tearing to pieces, with the greatest facility, the most powerful prey. Lion, Tiger, Panther, Cougar, Lynx, Domestic Cat, &c.

TRIBE III. AMPHIBIA.

Feet so short and so enveloped in skin that they only serve for creeping when upon land, but form excellent oars in the water; body much elongated; spine very movable, and provided with muscles which strongly flex it; five toes on all the feet; no clavicles nor bony rudiments suspended in the flesh; habitation most generally in the sea. Two genera.

GENUS I. PHOCA. Seal.

Four or six incisors above; four or two below; pointed canines in both jaws; grinders twenty to twenty-four, trenchant and conical, without any tuberculous portion; five toes to all the feet; those on the fore feet decreasing from the large to the little toe, while on the hind feet the large and little toe are longest. There are two divisions—*seals without external ears* and *seals with external ears*; those without have pointed incisors; all the toes endowed with a certain motion, and terminated by pointed claws placed upon the edge of the membrane which unites them. Those with external ears have the four upper incisors smaller, but with a double cutting edge; toes of the anterior limbs almost immovable; all the claws flat and thin.

GENUS II. TRICHECUS, Lin. Morse.

Under jaw without incisors or canines; upper jaw furnished with two long canines, like tusks, between which are two incisors; four cylindrical molars on each side and in each jaw; dental system arranged rather for the breaking of shells than for cutting soft substances or bruising vegetables.

ORDER IV. MARSUPIALIA.*

Premature production of their young, which, incapable of movement and possessing hardly the germs of limbs, attach themselves to the mammae of the mother, there to perfect their development. The skin of the abdomen generally disposed in the form of a pouch about the mammae, and supported by two articulated bones in the pelvis, called marsupial bones. One striking feature in this order is, that, although there is great similarity in one species to another, yet they vary very much in the teeth, digestive organs and feet. They appear to be the connecting link from the Carnaria to the Rodentia; and some animals having the marsupial bones, but entirely without teeth, have been placed with the Edentata. Six tribes.

TRIBE I. DIDELPHIIS, LIN. OPOSSUM.

Long canines and small incisors in both jaws. One remarkable genus, the *Opossums*, have fifty teeth; the posterior thumbs long and easily opposable, a circumstance which has caused them to be termed *Pedimana*; tail prehensile and in part naked; fetid, nocturnal animals, with a slow gait; habitation upon trees. [America alone.]

TRIBE II. PHALANGISTA, CUV. PHALANGERS.

Upper canines long and pointed; the inferior almost invisible; thumb large; the two toes united as far as the first phalanx. There are two remarkable genera. The *Phalanger proper* has a prehensile tail, often in a great measure scaly; diet insectivorous and fructivorous; habitation upon trees. [The Moluccas.] The *Flying Phalanger* has an extension of the skin of the sides, forming a parachute; habitation upon trees. [New Holland.]

TRIBE III. HYPsipRYMNUS, ILLIG. POTOROOS.

No posterior thumb nor inferior canines; toes united as in the Phalangers.

* Pouched.

TRIBE IV. MACROPUS, SHAW. KANGAROO.

No canines; legs of unequal height, the hinder ones the longest; tail short, muscular and serving as an organ of support and locomotion.

TRIBE V. KOALA, CUV.

Two long incisives in the under jaw; in the upper jaw two long incisives in the middle, small ones upon the sides, and two small canines. No tail.

TRIBE VI. PHASCOLOMES. POUCHED RATS.

True Rodentia in the teeth and intestines; no tail; form clumsy; body as if crushed; head large and flat; legs short; claws long and fit for digging; graminivorous.

ORDER V. RODENTIA.

In each jaw two large incisors, increasing during life, and of prismatic form; the enamel being concentrated to the front. No canines; molars with flat crowns, whose enamelled eminences are always transverse. Under jaw articulated by a longitudinal condyle, so as to have no horizontal movement except from behind to before, and vice-versâ, as is suitable for the action of gnawing. Carriage behind, in general, higher than before, making these animals leapers; intestines very long; stomach simple or little divided; cæcum very voluminous; brain nearly smooth, and without convolutions; eyes directed sideways, large in the nocturnal species, and diminishing as the habit is more subterranean; forearms have but little power of rotation, and the two bones are often united. Six remarkable genera.

GENUS I. SCIURUS, Lin. *Squirrel.*

Inferior incisors strongly compressed; tail long and well furnished with hair; four toes before and five behind; head broad; eyes projecting and lively; clavicles complete. Two subgenera.

SCIURUS, Cuv. *Squirrel proper.*

Hairs of the tail arranged upon the sides in the manner of a large feather; diet fructivorous; habitation upon trees. [Both continents.]

PTEROMYS. *Flying Squirrel.*

Feet with long bony appendages sustaining a lateral fold of the skin.

GENUS II. Mus, Lin. *Rat.*

Linnæus united under one head all the Rodentia provided with clavicles which he could not distinguish by some exterior mark. Six remarkable subgenera.

ARCTOMYS, Gm. *Marmot.*

Molars bristled, with conical joints, ten above, eight below; limbs short, with very strong claws; tail rudimental; four fingers, and one tubercle, supplying the place of the thumb, upon the fore-limbs; five behind. They live in societies, dig burrows and form within them beds of grass, upon which they pass the winter in torpor. Diet both insectivorous and fructivorous. From this F. Cuvier has separated those Marmots that have cheek-pouches. The Prairie Dog belongs to this subgenus.

Mus, Cuv. *Rat proper.*

Six molars in each jaw; four fingers and a vestige of a thumb before, five behind. Tail long and scaly. Diet omnivorous; voracious.

MYOXUS, Gm. *Dormice.*

Eight molars traversed by furrows in each jaw; inferior incisors pointed; tail very long, soft, and even tufted; habitation upon trees, where they live upon fruits; become torpid in winter.

CRICETUS, Cuv. *Hamsters.*

Six simple molars in each jaw; five toes on all the feet; cheek-pouches; stomach with double cavity; eyes large; tail hairy, short and soft; habitation in furrows of six or seven feet deep, dug by means of their claws, and whither they transport, in their cheek-pouches, considerable quantities of grain.

ARVICOLA, Lacep. **CAMPAGNOLS.** *Water and Field Rats.*

Three molars throughout, but without roots, and formed each of triangular prisms placed on two alternate lines. Tail moderately long and soft; ears pretty large.

DIPUS, Gm. *Jerboas.*

Posterior extremities of a disproportionate length; the metatarsus of the three middle toes formed of a single bone, resembling what is called the tarsus in Birds. Fore feet very short in proportion with those behind, and furnished with five toes. Sometimes to the hind feet there are two small lateral toes besides the three large middle ones. Tail long and tufted; progresses by huge leaps, sometimes of seven or eight feet.

GENUS III. CASTOR, Lin. *Beavers.*

Tail flattened horizontally, almost oval, and covered with scales. Five toes to each foot; those behind united by a membrane; that which comes next to the thumb has a double and oblique nail. Molars to the number of four everywhere, and with flat crowns. The known species inhabits principally the solitudes of North America, and constructs for the winter, upon the banks of rivers and lakes, ingenious dwellings, whose regular distribution, admired by all travellers, has been described in the most eloquent works. They live on the bark of trees, and unite to the number of three hundred, or thereabouts, to form colonies, and labour in establishing dikes against the streams.

GENUS IV. HISTRIX, Lin. *Porcupines.*

Head as if swollen; body armed with spines, very long and ringed in a regular manner with black and white; clavicles rudimentary; molars to the number of four throughout, with flat crowns, differently modified by plates of enamel, between which are depressed intervals. Tongue bristled, with spiny scales. Four toes before, five behind. They walk on the sole of the foot.

GENUS V. LEPUS, Lin. *Hares.*

Clavicles rudimentary; posterior limbs long; two small incisors behind the upper ones; five molars throughout, formed each of two vertical plates soldered together. Five toes be-

fore, four behind. Interior of the mouth and bottom of the feet furnished with hair like the rest of the body; ears long; tail short.

GENUS VI. CAVIA, Illig. *Guinea-Pigs.*

Molars composite, each only one simple lamina and one forked, no tail; toes free, four before, three behind. These are little timid Mammalia, living on dry soils, where they pass the day in the shelter of stones and brambles, seeking their food at night. The species so common in Europe under the name of Guinea-pig is originally from the immense forests of Brazil.

ORDER VI. EDENTATA.*

No incisive teeth in either jaw; sometimes canines and molars, sometimes molars only, often no teeth at all. Nails enveloping the ends of the toes, and approaching to the nature of hoofs; at least the rudiments of clavicles. Three families.

FAMILY I. TARDIGRADA.

So named from the slowness of their motions. Face short; molars cylindrical; canines sharp, longer than the molars; two pectoral mammae; toes united by the skin and terminated by enormous claws compressed and crooked, and when in repose, bent towards the palm of the hand or the sole of the foot; forearms much longer than the thighs and legs, making it a painful effort to walk. Habitation upon trees which they strip of leaves. One genus.

BRADYPUSS, Lin. *Sloth.*

Two species, the Ai and Unau, natives of the hot parts of America.

FAMILY II. EDENTATA ORDINARIA.

Ordinary Edentata with a pointed muzzle, and some with cheek teeth. Four genera.

* Without front teeth.

GENUS I. DASYPUS, Lin. *Armadillo.*

Body covered with a hard shell composed of compartments resembling small paving stones, which cover the body, the head, and often the tail; this substance is formed of three parts, a shield upon the front, a second very large upon the shoulders, a similar one upon the croup, and transverse movable bands between the two latter. Five nails on the hind foot, sometimes only four before, of which the two middle are longest; incisives and molars vary with the species.

GENUS II. MYRMECOPHAGA, Lin. *Ant-Eaters.*

Hairy animals, with pointed muzzle entirely without teeth, but provided with a large piliform tongue, which they insinuate into ant-hills and then withdraw in order to swallow the ants which their viscid saliva has caused to adhere. Nails throughout; those of the fore feet very trenchant.

GENUS III. ORYCTEROPUS, Geoff.

This genus was for a long time confounded with the Ant-Eaters, because they feed upon the same kind of food, have the same form of head and an extensible tongue. They differ, however, in being provided with molars, and nails fit for digging. The structure of their teeth is very peculiar; they are cylindrical and traversed in a longitudinal direction by a multitude of canals. Only one species known—the Earth Pig of the Cape of Good Hope.

GENUS IV. MANIS, Lin. *Pangolins.*

No teeth; tongue very extensible; body and tail entirely covered with large trenchant scales. Defend themselves by rolling into a ball.

FAMILY III. MONOTREMATA, GEOFF.

Animals of a singular structure, and subjects of long controversies among the learned. The organization intermediate between that of the three first classes of vertebrated animals, as the following characteristics show—mammæ; hair; a double clavicle; a spur on the hind feet of the males, pierced with a canal which discharges a poisonous liquid; no external conch to the ear; no enchausted teeth, nor fleshy lips; eyes very small. Two genera. Inhabit New Holland.

GENUS I. ECHIDNA, Cuv.

Muzzle very slender and elongated, terminated by a small mouth; tongue very extensible; body covered with very strong spines, sometimes intermingled with hair; feet short; nails strong, fit for digging; tail very short.

GENUS II. ORNITHORHYNCHUS, Blumenb.

Muzzle elongated, horny, wide, much depressed, in the form of a duck's bill, and garnished with small transverse laminæ. Mouth provided above and below with only two teeth without roots, and with flat crowns. Fore feet with a membrane between the toes; the hind ones have it only as far as the root of the nails. [Marshes of New Holland.]

ORDER VII. PACHYDERMATA.*

Feet with five, three, two or one toe unguiculated; that is to say, where one or more phalanges are entirely enveloped in a large nail called *hoof*, which renders prehension impossible; frequently three sorts of teeth, sometimes only two; no clavicles; stomach simple or divided into several pouches, but unfit for rumination; skin most frequently thick, naked or nearly so. Three families.

FAMILY I. PROBOSCIDIANA.

Five toes to each foot, incrusted with a callous skin which surrounds the foot, scarcely perceived except by the nails that appear to be attached to the edge of this skin or species of hoof; four to eight molars; no canine; incisives, projecting sufficiently to be called tusks, frequently attaining to a large size; trunk or proboscis very long; with it he conveys his food and water to his mouth; mammae, two in number, attached to the chest; the young suck with the mouth, not using the trunk for that purpose. There are two genera, of which one (*Mastodon*, Cuv.) is fossil.

* Thick skinned.

ELEPHAS, Lin. *Elephant.*

Molars with flat crowns composed of a certain number of vertical laminæ, each being formed of a bony substance enveloped with enamel and bound together by a cortical substance; size gigantic; skin very thick and wrinkled; ears very wide and flat; nose prolonged into a long movable trunk. They consume about a hundred pounds of hay per day, and from twelve to fifteen buckets of water. They will carry a burthen of three thousand pounds. Two species, the African and the Indian.

FAMILY II. PACHYDERMATA ORDINARIA.

The three kinds of teeth in the greatest number, in the rest at least two sorts; feet terminated by four toes at the most, and at the least by two. Four remarkable genera.

GENUS I. HIPPOPOTAMUS, Lin.

Feet terminated by small hoofs; six grinders throughout; very strong canines, of which the inferior are crooked; four incisors in each jaw; body very massive and devoid of hair; legs very short; stomach trailing nearly to the earth; tail short; head very large; eyes and ears small; diet herbivorous; habitation in the rivers of the middle and south of Africa. Only one species.

GENUS II. Sus, Lin. *Hog.*

The two middle toes large and with strong hoofs, the two exterior ones much shorter and not touching the earth; incisors varying in number; canines curve upwards and laterally; molars with tuberculous crowns; muzzle truncated and terminated by a snout. Body covered with bristles.

GENUS III. RHINOCEROS, Lin.

Three toes to each foot; skin very thick and wrinkled; one or two horns of a fibrous nature placed upon the middle line of the nose, of which the bones are exceedingly strong, and united in an arch for their support; this weapon serves them to fight with, and to disembowel their enemies the tiger and lion. They inhabit only the equatorial zone of the old continent.

GENUS IV. TAPIR, Lin.

Molars presenting in each before they are worn two transverse rectilinear eminences; six incisors and two canines in each jaw, separated from the molars by a vacant space; four toes to the fore feet and three to the hind ones. [South America and India.]

FAMILY III. SOLIPEDES.

Quadrupeds having only one apparent toe and a single hoof to such foot. One genus.

EQUUS, Lin. Horse.

Six incisors in each jaw, which, when the animal is young, have the crown ridged; six molars throughout, with square crowns marked with four crescents; two small canines in the males in the upper jaw (and sometimes in both jaws), which are almost always wanting in the females; stomach simple and of moderate size; intestines very long. The original country of these animals appears to be the deserts about the Caspian sea. They are found in the wild state in the plains of South America, where they live in troops of sometimes more than ten thousand, commanded by courageous leaders. The Horse, Ass, Zebra.

ORDER VIII. RUMINANTIA.

Incisors generally as many as eight in the under jaw alone, and replaced in the upper by a callous pad; between the incisors and molars is an empty space where, in some genera, we find one or two canines; molars generally to the number of six throughout; four feet terminated by two toes and two hoofs, which face each other by a flat surface, whence these animals are called *cloven-footed*; sometimes behind the hoof are two small spurs, traces of lateral toes; the two bones of the metacarpus and metatarsus are united into one called the cannon. There are always four stomachs: the first and largest is called the *paunch*; it receives, in large quantities,

vegetables coarsely bruised by a first mastication ; thence they are borne into the second, which is termed the *bonnet*, the sides of which have laminæ resembling those in a honey-comb ; this stomach, which is very small and globular, seizes the food, moistens it and compresses it into little pellets, which then successively ascend to the mouth to be rechewed. The animal remains in repose during this operation, which is continued until all the food received into the paunch has been subjected to it. When thus rechewed it descends directly into the third stomach, called the *leaflet* on account of its sides having longitudinal laminæ resembling the leaves of a book : thence again it passes into the fourth stomach or *rennet*, whose sides have only wrinkles, and which is the true organ of digestion. Three sections.

Section I. Ruminantia without Horns.

There are two genera, the genus *Camelus* and the genus *Moschus*, Lin., Musk.

GENUS CAMELUS, Lin. *Camel.*

Canines in both jaws ; two pointed teeth implanted in the incisive bone ; inferior incisives to the number of six ; eighteen or twenty molars ; upper lips tumid and cleft ; neck long ; instead of the large hoof flattened upon the internal side, which envelopes the whole inferior portion of each toe, and which determines the figure of the ordinary cloven foot, they have merely one small one which adheres to the last phalanx, and is of symmetrical form ; large masses of cells cover the sides of the paunch. Two subgenera.

SUBGENUS CAMELUS, Cuv. *Camel proper.*

Toes united below, nearly to the point, by a common sole, horny and favourable to progression upon sand ; lumps of fat upon the back ; a second canine in the under jaw ; four mammae. There are camels with one and camels with two humps. [Old Continent.]

SUBGENUS AUCHENIA, Illig. *Lama.*

Toes separate ; no lumps ; no second canines in the under jaw ; no mammae ; size much less than in the Camel. [New Continent.]

GENUS *Moschus*, Lin. *Musk.*

A long canine on each side of the upper jaw and projecting from the mouth in the males; body slender; feet small; tail very short; hair short; hoofs formed like those of the ordinary Ruminantia; no lachrymal apparatus; one species has a kind of pouch placed under the belly of the male, in which is inclosed a strong odorous humour known by the name of *Musk*; the others have no pouch. [Old Continent.]

Section II. *Ruminantia with Solid Horns.*GENUS *CERVUS*, Lin. *Stag.*

The Stag is an animal of a stately, elegant form; when full grown he is commonly between four and five feet high; often, when he enjoys abundance of food, and lives undisturbed by man or the beasts of prey, he attains a much larger size; his legs are slender and elegant; tail short; ears large and pointed; his horns lofty and branched. The female is of a smaller and more slender form, and destitute of horns. A reddish brown colour, which has gained this genus the appellation of Red Deer, distinguishes the upper part of the body; the hinder part of the neck and the space between the shoulders are marked with a black list; some part of the face is commonly black; the sides and under part are white. The Stag loses and renews his horns annually, and, for a while, each set of horns is adorned with an additional branch. The young has no horns the first year; in his second year his horns are single and straight, and, till his sixth, the number of the antlers continues to increase. From this period they are multiplied so irregularly, that the animal's age is estimated not so much by the number of the antlers as by the size and thickness of the whole horns. The sprouting horns are at first extremely tender, and covered over with blood-vessels. They grow not like the horns of the Bull, the Sheep or the Goat, by shooting out new matter at the roots, and moving forward that which is already formed, but, like trees and other vegetable bodies, increase their length by additions at the points. Delicacy and acuteness of the senses distinguish the Stag in an eminent degree; his sense of smell is exquisite; his eye is sparkling, soft and glowing with ex-

pression ; he hears distinct and low sounds, and is not incapable of relishing the melody of music. One mode of hunting this animal, practised in ancient *Greece*, was for two persons to go out together, and one to charm the unsuspecting Stag with the melody of his voice or his pipe, till the other approached near enough to pierce him with a dart or arrow. These animals run with great swiftness, living generally in forests upon grass, leaves and buds. The various species are scattered throughout North and South America, Europe and Asia.

GENUS CAMELOPARDALIS, Lin. *Giraffe.*

These beautiful animals are of a reddish colour, with darker spots. The hair of the tail is most frequently black. The extreme length of his neck and shoulders renders it difficult for him to crop grass from the ground. He feeds chiefly therefore on the leaves and tender shoots of trees. Horns in both sexes always covered by a soft skin and never falling ; no larmier or muzzle ; ears long and pointed. The one sole species of this genus embraces the tallest of animals. Timid and gentle these Ruminantia defend themselves with great courage against the attack of large Carnivora.

Section III. *Ruminantia with Hollow Horns*

Are the most numerous section of this order.

GENUS ANTILOPE.

In size and shape these animals bear great resemblance to the Elk. The forehead of the Antelope is flat and broad above the eyes, but from the eyes to the tip of the nose becomes gradually narrower till it terminates in a sharp point ; the breast is furnished with a dewlap covered with long hair ; on the upper part of the forehead stands a tuft of hair erect ; the ears are long and pointed ; though the body is of a thick robust form the legs are slender and elegant ; the horns are generally about two feet long, of a dark brown colour, generally twisted in various ways, according to the species ; the hoofs are short and surrounded at their junction with the leg with a circle of black hairs. These Ruminantia are nearly altogether natives of the Old Continent ; some have been found in the prairies of North America. Their disposition

is mild and sociable ; they live in herds ; some having five thousand in number are occasionally met with in Africa.

GENUS *CAPRA*, Lin. *Goat.*

Horns directed upwards and backwards ; chin usually furnished with a long beard ; forehead almost always concave.

GENUS *OVIS*, Lin. *Sheep.*

Horns directed backwards, but inclining spirally more or less forwards ; forehead generally convex ; no beard.

GENUS *BOS*, Lin. *Ox.*

Horns directed laterally, inclining upwards or forwards in the form of a crescent ; muzzle broad ; body short, thick and high ; legs robust ; a dewlap ; nails behind the hoof.

ORDER IX. CETACEA.

The grand classical characters which nature has imprinted on the cetaceous order will, in a philosophical view, vindicate their arrangement among the Mammalia. Their internal structure agrees, in every respect, with that of the *Mammalia* of Cuvier ; and their external conformation also is in some other parts similar. Being destitute of gills, they breathe by means of lungs, which obliges them frequently to rise to the surface of the water for fresh air. Another great resemblance to the Mammalia is their having warm blood and being provided with mammae, with which they suckle their young, protecting them with parental attachment.

Body fish-formed, terminated by a horizontal fin, in place of posterior limbs. The anterior limbs likewise arranged as fins ; toes enveloped in a covering, and without nails ; some vestige of a pelvis, without articulation to the vertebral column.

The cervical portion of the dorsal spine very short ; skin smooth and more or less thick ; no ears externally, nor movable eyelids, nor lachrymal apparatus ; eyes large ; crystalline surface very much convex ; habitation in the sea. Two families.

FAMILY I. HERBIVOROUS CETACEA.

No blow-holes; pectoral mammæ; mustachios of hair; anterior fins serving for prehension; molars with flat crowns; sometimes tusks. One remarkable genus.

MANATUS, Cuv. *The Lamantins.*

Manati or Cow Whales have an oblong body; molar teeth, marked with two transverse ridges upon their crowns; no canines in adult age; some traces of nails upon the end of the pectoral fins; skin very thick and naked; mustachios very strong and close.

FAMILY II. CETACEA ORDINARIA. BLOWERS.

Conical teeth, or none; no vestige of hair; nostrils opening without, on the top of the head, very far from the end of the muzzle; nasal fosses so arranged as to permit them to reject by these openings the water which they take with their prey into their enormous mouth. Four genera.

GENUS I. DOLPHINUS, Lin.

The general features which distinguish the Dolphins are simple and few. They have teeth in both jaws, all simple, and almost always conical; these are the most carnivorous and the most cruel of the order; a dorsal fin always single; snout considerably elongated, broad at the base, round at the extremity, resembling the bill of a Goose.

GENUS II. MONODON, Lin. *Narwhals.*

The Narwhal has no true teeth in either jaw; but in the upper are found the distinguishing characters of the genus, two long, straight and pointed tusks, like spears, spirally twisted, implanted in the maxillary bone, and directed to the front.

Pectorals remarkably small for so large an animal, no dorsal fin, head about one seventh part of its whole length.

GENUS III. PHYSETER, Lin. *Cachalots.*

Under this genus we describe the Cachalot or Spermaceti Whale. Head enormous and nearly square and generally one-third of its whole body; snout very obtuse and truncated; lower jaw very narrow, containing teeth, none in the upper

jaw; blow hole twelve inches long in the form of an f, on the anterior extremity of the head; pectorals small and obtuse; head divided into cavities or cells communicating with each other, filled with oil which is fluid when the animal is living, when dead takes the concrete form which we denote *spermaceti*.

GENUS IV. *Phocoena*, Cuv.

The Porpoise is of all the Cetacea perhaps best known to us. We shall give the general description in the words of Cuvier. "It has absolutely no hair, not even eyelashes. Its skin is perfectly smooth, and its scarf skin is soft to the touch and easily detached. It has no lips properly so called; but the skin, always sleek and black, is somewhat strengthened at its union with the gums. The eye is small and situated nearly in the line of the opening of the mouth; the eyelids are soft and have very little play; their internal surface is moistened with mucus, but there are no *puncta lacrymalia*, and consequently no tears. The iris is yellowish; the pupil in form of a v reversed. The opening to the ear is not larger than the point of a pin; that of the blowhole is placed on the top of the head between the eyes, resembling a crescent. No osseous parts in either tail or dorsal fin, but composed almost wholly of fat."

GENUS V. *BALÆNA*, Lin. *Whales*.

Resembling in size and appearance the Cachalots, but the head not so much enlarged in front; no teeth. The two sides of the upper jaw are armed with transverse laminæ called whalebone; lower jaw unarmed. Live upon Worms, Mollusca and Zoophytes. One species (*B. Mysticetus*) affords the whale oil of commerce.

AVES.

Birds are oviparous Vertebrata with a double circulation and respiration, organized for flight.

The lungs, which are not separated from the abdomen by a perfect diaphragm, are undivided, fixed to the ribs, and surrounded by a membrane pierced with large holes, so that the air passes into the cavity of the chest, the abdomen, the arm-pits and even into the cavities of the bones, which are hollow.

Their anterior extremities cannot serve either for standing or prehension; they are consequently bipeds, and take their food by means of the mouth. The two clavicles are joined together and form what is called the *fourchette*. This, with the projections of the scapula, keeps the shoulders asunder. The wing supported by the humerus, the fore arm and the enlarged hand, has throughout its length a range of elastic feathers which offer a large surface of resistance to the air. The feathers of the hand, always ten in number, are called *primaries*; of the fore arm, varying in number, *secondaries*; of the humerus, which are less strong, *scapularies*; those of the thumb *bastards*. The bony tail is very short, but supports a range of strong feathers from twelve to eighteen in number. The weaker feathers ranged along the base of the quills are called the *wing* and *tail coverts*.

The legs have a femur, a tibia and fibula, a tarsus and metatarsus represented by a single bone terminated by three pulleys and to which are attached commonly three toes and a thumb. There are also certain muscles attached to the pelvis and passing over the knee and heel to the toes, so that the weight of the body suffices to flex them and thus allows the bird to sleep perched upon its feet.

ORDER I. RAPACEÆ.*

Beak bent at the extremity; upper mandible dilated on each side, or armed with a tooth; feet robust, short, with three toes before and one behind, armed with claws generally sharp; sternum without lateral slopes. The species comprised under this head are voracious and cruel; they are among Birds, what the Carnivora are among Quadrupeds; they live on prey or carrion, and construct their nests, called *eyries*, in elevated places; lay generally three or four eggs; they are monogamous. Two families.

FAMILY I. DIURNAL BIRDS.

Head compressed laterally; eyes situated at the sides; toes without feathers; exterior toe always directed to the front, and most frequently united by its base to the middle toe by the aid of a small membrane; nostrils pierced in a membrane called the *cera*; stomach almost altogether membranous; intestines short. Three tribes.

TRIBE I. VULTUR, LIN. VULTURES.

Eyes even with the head; the tarsi reticulated, that is to say, covered with small scales; an elongated beak curved only at the end; a greater or less portion of the head and neck divested of feathers; wings so long that in walking they hold them half extended; talons feeble in proportion to their size. Four genera.

GENUS VULTUR, Cuv. *Vulture proper.*

Head and neck naked; collar of long feathers and down at the root of the neck; beak large and strong; nostrils disposed transversely at its base; no caruncles (a kind of fleshy excrescence). [Old Continent.]

GENUS SARCORAMPHUS, Dum.

Base of the beak surmounted with caruncles; nostrils oval and longitudinal. [America only.]

* Birds of prey.

GENUS CATHARTES.

Beak as in the preceding, wide and with oval and longitudinal nostrils, but no caruncles; head and neck naked.

GENUS PERCNOPTERUS.

Beak long, slender and slightly inflated above its curvature; nostrils oval and longitudinal; only the head naked.

TRIBE II. GYPACTOS, STORR. GRIFFINS.

Eyes and talons as in the preceding; head entirely covered with feathers; beak very strong and straight, with a crook at the end, and inflated at the curve; nostrils covered by stiff hairs directed forwards; tarsi short and feathered to the toes. One species only.

TRIBE III. FALCO, LIN. FALCONS.

Head and neck clothed in feathers; a projection of the eyebrows, causing the eye to appear sunk; blood-thirsty and endowed with a strength which permits them to satisfy their insatiable appetite; the female is larger than the male, and on this account is called, in falconry, the *tarsel* or *tiersel*. The Falcons are the tyrants of the air; it is among them that poetry has chosen the king of Birds. Two sections.

Section I. Noble Birds of Prey.

Beak curved from its base; second quill of the wing the longest. Two genera.

GENUS FALCO, Bechst. *Falcon proper.*

Upper mandible armed with a strong tooth towards the point; wings as long or longer than the tail.

GENUS HIEROFALCO, Cuv. *Gerfalcon.*

A simple emargination of the beak; tail long and displayed, extending remarkably beyond the wings.

Section II. Ignoble Birds of Prey.

Fourth quill of the wing generally the longest; beak furnished about its middle with a simple emargination in place of a lateral tooth towards its point. Four remarkable genera.

GENUS *AQUILA*, Briss. *Eagle.*

Tarsus as short, or but little longer, than the middle toe; beak straight at the base, and bending only at the point. Two remarkable subgenera—the *Eagle proper*, *Aquila*, Cuv., which has the tarsus feathered down to the root of the toes, and the *Fisher Eagle*, *Haliætos*, Savig., which has the tarsus feathered only in the upper half.

GENUS *ASTUR*, Bechst. *Goshawk and Sparrowhawk.*

Wings shorter than the tail; but the beak curved from its base.

GENUS *MILVUS*, Bechst. *Kite.*

Tail forked; wings excessively long; beak small; tarsi short; nails feeble.

GENUS *BUTEO*, Bechst. *Buzzard.*

Wings very long; tail equal; feet strong; interval between the eyes and beak naked; the beak curved from its base as in the preceding.

FAMILY II. NOCTURNAL BIRDS.

Large head; eyes very large, directed forwards and surrounded with a circle of fringed feathers, the anterior of which cover the *cera* of the beak, and the posterior the opening of the ear; pupil of the eye very large; exterior toe of the foot free, and capable of being directed at will forwards or backwards; apparatus of flight weak; *fourchette* having little strength; feathers with soft beards covered with fine down. Form but one genus.

GENUS *STRIX*, Lin.

They may be divided by their tufts, the size of their ears and the extent of the circle of feathers around their eyes.

SUBGENUS *OTUS*, Cuv. *Horned Owls.*

Have two tufts of feathers (*aigrettes*) on the forehead which they can erect at will; the conch of the ear extending in a semicircle from the beak to the top of the head; beak curved; feet feathered to the nails.

SUBGENUS STRIX, Sav. *Screech Owl.*

Ear as large as in the former ; beak straight, bent only towards the end ; no aigrettes on the head ; tarsi feathered.

SUBGENUS SYRNIUM.

Conch small and not occupying the half of the height of the cranium ; no aigrettes ; feet feathered to the nails.

SUBGENUS BUZO.

Conch small ; aigrettes.

SUBGENUS NOCTUA, Savig. *Chouette.*

Ears level with the head ; no aigrettes ; circle of feathers small ; toes naked.

SUBGENUS SCOPS.

Ears level with the head ; aigrettes ; naked toes.

ORDER II. PASSERINÆ.

Four toes, three before and one behind, which distinguishes them from the Climbers ; tarsi weak and short, which separates them from the Waders ; exterior toes united by a short membrane, which removes them from the Palmipedes. The character of the beak and nails, joined with the preceding, separates them from Birds of Prey. The stomach is a muscular gizzard. Length of wing and extent of flight variable. Sternum has a single notch on each side, except in some genera, where there are two. Food consists of fruits, insects, grain, according to the thickness of the beak. Five families, of which the four first include birds whose exterior toes are only united by one or by two phalanges. Plate 17 only contains the two first.

FAMILY I. DENTIROSTRES.

Beak notched on both sides of the point. Ten remarkable genera distinguished by the form of the bill.

GENUS LANIUS. *Shrike.*

Beak very much compressed, and more or less bent towards the end. Toes entirely free. An ardent and courageous temper, which urges them to contests where they frequently expire in the clutches of a dying enemy.

GENUS MUSCICAPA, Lin. *Fly-Catcher.*

Beak depressed horizontally; more or less curved and notched at the point, and furnished with hairs at the base.

GENUS AMPELIS, Lin. *Crown-Bird.*

Beak short, depressed, wide and slightly arched. A brilliant plumage generally decks these timid and taciturn birds; they inhabit the warm regions of America.

GENUS TANAGRA, Lin. *Tanager.*

Beak conical, triangular at base and notched, with the ridge arched. Wings short. They inhabit America, and are remarkable for the brilliancy of their colours.

GENUS TURDUS, Lin. *Thrush.*

Beak compressed and arcuated, but without the crook at the point, which is also less strongly indented than in the Shrikes. Two subgenera, the *Thrush proper* and the *Spotted Thrush*. The former has its colour uniform or distributed in large masses; the latter has the plumage speckled with black and brown.

GENUS ORIOLUS, Lin. *Orioles.*

Beak like the thrush, but somewhat stronger; feet shorter; wings a little longer.

GENUS CINCLUS, Bechst. *Water-Thrush.*

Beak compressed and straight, with mandibles of an equal height, nearly linear, and growing sharp towards the point, the upper one hardly arcuated.

GENUS MÆNURA. *Lyra.*

Beak slightly compressed and notched; nails obtuse and long like fingers; males have a long tail with plumes in the form of a lyre.

GENUS MOTACILLA. *Warbler.*

Beak straight, fine, and resembling a bodkin. Three remarkable subgenera; the *Fauvettes* with the beak straight and

slim throughout; the *Wren* with a beak perfectly conical and pointed, and the *Meadow-Larks* with a slim beak, and the nail of the thumb very long.

GENUS PIPRA, Lin. *Manakin.*

A compressed bill higher than broad, and emarginated; tail and feet short; two external toes united at the base for one-third their length. Two subgenera.

SUBGENUS RUPICOLA, Briss. *Cock of the Rock.*

Large and beautiful birds, having a double vertical crest on the head.

SUBGENUS PIPRA, Cuv. *Manakins proper.*

Small birds remarkable for their lively colours; no crest.

FAMILY II. FISSIROSTRES.

Beak short, broad, flattened horizontally, slightly crooked, without notches, and with an extended commissure. Two remarkable genera, one nocturnal, the other diurnal.

GENUS CAPRIMULGUS, Lin. *Goatsucker.*

Mouth excessively large; beak depressed, very small, curved at the end, garnished with strong mustachios; nostrils in the form of small tubes. These solitary birds only fly during twilight, or upon fine nights, and pursue Phalenæ and other nocturnal insects.

GENUS HIRUNDO. *Swallow.*

Wings very long; flight rapid; plumage thick; flight diurnal. They are remarkable for their industry in building their nests. Two subgenera—the *Swallow proper*, which has the toes of the feet as in the other Passerinæ, and the sternum notched; and the *Martinet*, which has wings excessively long; a very powerful flight; tail always forked; feet very short; the thumb capable of turning forward as the other toes; and no notch in the sternum.

FAMILY III. CONIROSTRES.

Beak strong, more or less conical, and without emargination. Six remarkable genera.

GENUS ALAUDA, Lin. *Lark.*

Beak cylindrical; toes entirely free; nail of the thumb longer than the thumb itself; regimen granivorous.

GENUS PARUS, Lin. *Titmouse.*

Beak compressed, slender and short, furnished with short hairs at the base; nail of the thumb much curved; regimen omnivorous.

GENUS EMBERIZA, Lin. *Bunting.*

Beak short, with the upper mandible narrowest and provided with a projecting tubercle on the palate; regimen granivorous.

GENUS FRINGILLA. *Sparrow.*

Beak conical and more or less thick at base; they live generally on grain. The Sparrows proper, have the beak short, conical and a little inflated towards the point. There are two remarkable subgenera—the *Finch* whose beak is somewhat less arcuated than that of the Sparrow, and stronger than that of the Linnet—and the *Linnet* which has the beak exactly conical without being inflated. Those are called *Goldfinches* which have the beak a little longer and more pointed. The species which are more or less greenish are called *Tarins* or *Serins* by the French.

GENUS CORVUS, Lin. *Crow.*

Beak straight and strong, with trenchant edges; nostrils covered with stiff feathers.

SUBGENUS CORAX, Cuv. *Raven.*

Tail rounded or square; upper mandible arcuated.

SUBGENUS PICA, Cuv. *Pie.*

Tail long and cuneiform; upper mandible arcuated.

SUBGENUS GARRULUS, Cuv. *Jay.*

Tail displayed, but little elongated; the two mandibles terminated by a sudden curve.

GENUS PARADISÆA. *Birds of Paradise.*

Beak of medium size; nostrils covered with velvet feathers; feathers of the sides plumose, singularly developed.

The velvet and metallic appearance which so beautifully distinguishes these birds, and which, from its exceeding

splendour, has given rise to the "Bird of Paradise," is attributed to the influence of the climate they inhabit. This influence has been noticed in several other genera. They are natives of New Guinea and the adjoining islands, and are usually procured by Europeans from the savages of those regions, who prepare the birds for sale by cutting off the wings and feet. This circumstance has given rise to the common idea that they were really destitute of those members, and supported themselves always in the air. They live on fruit and are extravagantly fond of spices.

FAMILY IV. TENUIROSTRES.

Beak slim, elongated, without emargination, sometimes straight, sometimes more or less arcuated. Three remarkable genera.

GENUS SITTA, Lin. *Nuthatch.*

Beak straight, prismatic, pointed, and serving the same purposes as the Woodpecker's. Tongue not extensible; nostrils, upon close inspection, seem to be covered with hair; quills of the tail of no support in the action of climbing.

GENUS CERTHIA, Lin. *Creeper.*

Beak arcuated at three angles, compressed and pointed; tongue entire; nostrils half closed by an arched membrane. Quills of the tail serving to climb.

GENUS TROCHILUS, Lin. *Humming-Bird.*

Beak long, slim, straight or arcuated, and tubulous. Tongue extensible and split almost to its base. The subgenus *Orthorhynchus* has the beak straight. The subgenus *Trochilus proper* has it arcuated. These birds, like the Birds of Paradise, are celebrated for the metallic lustre of their plumage, and, especially, for a species of laminæ as brilliant as precious stones, which are formed by a peculiar kind of scaly feather on the throat and head. The split tongue is protruded to a great length, and employed in taking up the nectar of flowers. They feed also on small Insects, of which the stomach is frequently found to be full. Their very small feet, long and narrow wings, displayed tail, short humerus and broad sternum without emargination, give them extraordinary powers

of flight. Their rapidity is proportionably greater than that of any other bird, and they balance themselves in the air with nearly as much ease as certain flies. They live singly and are exceedingly courageous.

FAMILY V. SYNDACTILÆ.

Exterior toe nearly as long as the middle one, to which it is united as far as the penultimate articulation. Three remarkable genera.

GENUS ALCEDO, Lin. *King-Fisher.*

Beak triangular, long, straight and nearly pointed; tail very short. [Both Continents.]

GENUS MEROPS, Lin. *Bee-Eater.*

Beak elongated, arcuated and trenchant, with an elevated ridge; feet very short. [Old Continent.]

GENUS BUCEROS, Lin. *Hornbill.*

Beak enormous, dentated, cellular and surmounted with a prominence or with a simple swelling, varying with the age. [India and Africa.]

ORDER III. SCANSORIÆ.*

External toe directed backwards like the thumb, whence results to them a more solid support, of which certain genera take advantage in clinging to and climbing upon trees; sternum presenting nearly always two emarginations behind; flight middling; regimen fructivorous or insectivorous, according as the beak is more or less robust; they build their nests in the trunks of old trees. Five remarkable genera.

GENUS PICUS, Lin. *Woodpecker.*

Beak long, straight, angular, the end compressed into a wedge, and fitted for splitting the bark of trees; tongue slender, armed near the tip with spines that curve backward, and capable of being thrust far out of the beak; tail com-

* Climbers.

posed of ten quills, with stiff and elastic stems, which sustain them as a prop while climbing trees.

GENUS YUNX, Lin. Wryneck.

Tongue extensible as in the Woodpeckers, but without spines; beak straight, pointed, nearly round and without angles; their tail has only the ordinary feathers; they live nearly like the Woodpecker, but climb little.

GENUS CUCULUS, Lin. Cuckoo.

Beak middling, well cleft, compressed and slightly arcuated; tail long; regimen insectivorous; birds of passage. The female of the true Cuckoo builds no nest in which to deposit her eggs, but abandons them in the nest of some other species, which hatches them with its own; the others build for themselves.

GENUS RHAMPHASTOS, Lin. Toucan.

Beak voluminous, nearly as large as the bird, light and nearly cellular within, arcuated near the end, irregularly indented along the edges; tongue long, narrow and furnished on each side with barbs like a feather. They are only found in the tropical countries of America. The front of their neck is generally decked with vivid colours, and its feathers were formerly often employed in the dress of French and American ladies.

GENUS PSITTACUS. Parrot.

Beak stout, hard, solid, rounded on all sides, and enveloped at base by a membrane in which the nostrils are pierced; tongue thick, fleshy and rounded—two circumstances which give them the greatest facility in imitating the human voice; the inferior larynx somewhat complicated; their food consists of all kinds of fruit; they climb among the branches of trees with the aid of their beak and claws; build in the trunks of trees; have a voice naturally harsh and disagreeable; they are almost always adorned with the most lively plumage; hardly any of them are found beyond the torrid zone; there are some, however, in both continents. They congregate in forests, where they make great havock.

SUBGENUS ARA. *Maccare.*

Tail displayed and long ; cheeks without feathers. [America.]

SUBGENUS PAROQUET.

Tail long ; cheeks feathered ; a naked space around the eye.

SUBGENUS COCKATOO.

Tail short, equal or squared ; cheeks feathered ; a movable crest.

SUBGENUS PAROQUET PROPER.

Tail equally cuneiform ; no crest.

SUBGENUS TRUMPET PAROQUET.

Tail short and square ; a crest ; cheeks denuded ; upper beak enormous.

ORDER IV. GALLINACEÆ.

Upper mandible arched ; nostrils pierced in a large membranous space at the base of the beak, and covered by a cartilaginous scale ; a heavy carriage ; short wings ; the bony sternum diminished by two emarginations so wide and deep that they occupy nearly the whole sides ; fourchette articulated by a simple ligament ; flight feeble ; anterior toes united at base by a short membrane, and indented throughout. The *Pigeons* and another genus are the only kind which have not this membrane ; their usual food is grain ; crop extremely large, and gizzard vigorous.

GENUS PAVO, Lin. *Peacock.*

An aigrette or crest on the head ; beak naked at its base ; the coverts of the tail of the males more elongated than the quills, and capable of being erected so as to form a wheel. The domestic Peacock is a native of India, and was brought thence by Alexander.

GENUS ALECTOR, Merr. *Hocco.*

Beak robust, with the upper mandible the longest, bent, and surrounded with a skin where the nostrils are pierced ; head crested ; no spur.

GENUS MELEAGRIS, Lin. *Turkey.*

Head and upper part of the neck invested with a skin without feathers, and papillated; an appendage under the throat and another conical one on the forehead; coverts of the tail short and stiff, capable of being erected; weak spurs on the males.

GENUS NUMIDA, Lin. *Guinea-Fowl.*

Head naked and surmounted with a callous crest; fleshy wattles at the bottom of the cheeks; tail short and pendent; no spurs.

GENUS PHASIANUS, Lin. *Pheasant.*

Cheeks partially divested of feathers and covered with a red skin; feathers of the tail variously disposed in the form of a roof.

SUBGENUS GALLUS. *Cock.*

Head surmounted with a fleshy vertical crest; inferior mandible furnished on each side with fleshy wattles; quills of the tail forming two vertical planes, back to back; a long spur.

SUBGENUS PHEASANT PROPER.

Head without fleshy crest; beak and cheeks naked; tail long, displayed, the quills being spread, each in two planes, one covering the other as in a roof.

GENUS TETRAO.

A naked band, most usually red, holding the place of an eyebrow. Two subgenera.

SUBGENUS TETRAO, Lath. *Grouse.*

Feet covered with feathers; no spurs; toes naked; tail round or forked.

SUBGENUS LAGOPUS. *Piarmigan.*

Toes as well as feet covered with feathers; tail square or round.

GENUS PERDIX.

Tarsi as well as toes naked. Four subgenera.

SUBGENUS FRANCOLINUS, Tem.

Beak long and strong; tail enlarged; spurs strong.

SUBGENUS PERDIX. *Common Partridge.*

Beak not so strong ; the males have a short spur or only a tubercle, the females none.

SUBGENUS ORTYX. *American Partridge.*

Beaker stronger, shorter and more convex ; tail larger ; no spurs.

SUBGENUS COTURNIX. *Quail.*

Beak more slender ; tail shorter ; no red eyebrows ; no spurs.

GENUS COLUMBA, Lin. *Pigeon.*

Beak compressed ; arcuated at base and covered with a soft tumid skin ; toes divided ; flight strong ; tail composed of twelve quills only.

ORDER V. GRALLATORIÆ.*

Lower part of the leg naked ; tarsi most generally elevated ; two circumstances which permit them to enter the water without wetting their feathers, to wade through it, and fish by means of their neck and beak. Those which have the beak strong, feed on Fish and Reptiles ; those which have it weak, on Worms and Insects. A very few content themselves, in part, with grain or grass, and these alone, live at a distance from the water. Exterior toe joined by its base to that of the middle one by means of a short membrane ; sometimes there are two membranes and at others the membrane is entirely wanting ; the toes likewise are sometimes bordered all along or palmated. No thumb in certain genera. Wings usually long ; legs, while flying, extended behind. Eight families, of which three hardly are entitled to this name.

FAMILY I. BREVIPPENNES. SHORT-WINGED.

Size so considerable that all the muscular power (apparently) at the command of nature would be insufficient to enable them to fly. Wings very small and unfit for flight ;

* Waders.

sternum flat, without ridge; pectoral muscles weak; those of the thigh and leg enormously thick; the thumb always deficient. Two genera.

GENUS STRUTHIO, Lin. *Ostrich.*

Beak depressed horizontally, of moderate length and blunt at the end; tongue short, and rounded like a crescent; eye large, the lid fringed with lashes. Legs and tarsi very long. Rapidity of course greater than that of any of the Mammalia; feet furnished with two or three toes, either all with nails or none; crop enormous, followed by a considerable sac between it and the gizzard. Africa and South America.

GENUS CASUARIUS, Briss. *Cassowary.*

Wings still shorter than those of the Ostrich, and totally useless even in running. Feet with three toes all furnished with nails; barbs of the feathers so scantily furnished with barbulæ, that at a distance they appear covered with pendent hair. India and New Holland.

FAMILY II. PRESSIROSTRES.

Long legs, without thumbs, or with one so short as to be unable to reach the earth; beak of moderate size and sufficiently strong to penetrate the earth in the search for Worms. Three remarkable genera.

GENUS OTIS, Lin. *Bustard.*

Beak nearly straight, and compressed; wings short; toes short and bordered with membranes; no thumbs.

GENUS CHARADRIUS, Lin. *Plover.*

Beak moderate, enlarged at the end, and the nostrils occupying one half to two-thirds of its length; no thumb.

GENUS VANELLUS, Bechst. *Lapwing.*

Same beak as the Plover, but a small thumb.

FAMILY III. CULTRIROSTRES.

Beak thick, long and strong, generally trenchant and pointed. Three tribes.

TRIBE I.

Beak straight, and slightly cleft; nostrils occupying nearly one half its length; toes moderate, the external ones a little palmated; thumb very short; part of the head and neck naked. There is only one genus—*Grus* (Crane)—but this has two subgenera, viz., *Psophia*, Lin. (Trumpeter), where the beak is shorter than in the other species, the head and neck clothed only with down, and the circumference of the eye naked—and the *Ordinary Crane*, where the beak is as long or longer than the head.

TRIBE II.

Beak stronger; toes larger. One remarkable genus only—that of the *Ardea*, Cuv. (Heron). Here a cleft of the beak extends to beneath the eyes; nails long, the middle with indented edge; external web remarkable. Three subgenera, but they are not well marked.

SUBGENUS TRUE HERON.

Neck very slender and furnished towards the bottom with long pendent feathers.

SUBGENUS BITTERN.

Feathers of the neck loose and separated; beak raised towards the heavens when at rest.

SUBGENUS NIGHT-HERON.

Port of the Bittern; beak thicker in proportion; some sparse feathers upon the occiput.

TRIBE III.

Besides a beak smoother than in the preceding, these have webs nearly equal between the base of the toes. Two remarkable genera—the genus *Ciconia*, Cuv. (Stork), with a beak straight, thick, pointed and slightly cloven—and the genus *Platalea*, Lin. (Spoon-bill) with a long beak terminated by a disk flattened in the form of a spatula.

FAMILY IV. LONGIROSTRES.

Beak slender, long and weak, which restricts these birds to a mere searching in the mud for Worms and Insects. Two

remarkable genera. The genus *Scolopax*, Lin. (Snipe) has a beak either curved at the bottom or straight. There are two subgenera.

SUBGENUS *IBIS*.

Beak arcuated, slender, obtuse and almost square at base; nostrils prolonged into a furrow which extends to the end of the beak; head or neck partially naked; thumb resting upon the ground; external toes remarkably palmated.

SUBGENUS *SCOLOPAX*, Cuv. *Snipe proper.*

Beak long and straight with the point inflated; feet without web; large eyes placed very much behind.

SUBGENUS *LIMOSA*, Bechst. *Godwit.*

Beak like the Snipe but longer; legs longer; feet palmated. Sea shore Birds.

GENUS *RECURVIROSTRA*, Lin. *Aveset.*

Beak long, thin, pointed, smooth, elastic and curved upwards; feet webbed to near the ends of the toes.

FAMILY V. MACRODACTYLI.

Toes very long and fit for running upon grass and marshy ground, or even for swimming, especially in those species where they are bordered with a membrane, without being webbed. Sternum narrow. Three remarkable genera.

GENUS *PARRA*, Lin.

Wings armed with a spur; four long toes divided down to the root with extremely long and pointed nails, a peculiarity from which they have received the name of *Surgeons*. Asia and South America.

GENUS *RALLUS*. *Rail.*

Wings unarmed; beak straight or moderately curved, cylindrical at the point, without frontal plate. Toes not bordered.

GENUS *FULICA*, Lin. *Coot.*

Wings unarmed; beak prolonged into a kind of shield which covers the forehead. Three subgenera.

SUBGENUS GALLINULA, Briss. *Water-Hen.*

Beak as in the Rail, but a frontal shield, and very long toes furnished with a narrow border.

SUBGENUS PORPHYRIO.

Beak higher in proportion to its length; toes very long and almost without border.

SUBGENUS FULICA. *True Coot.*

Short beak and large frontal shield; toes greatly widened by a festooned border, which renders them excellent swimmers.

FAMILY VI. VAGINALIS, LATH. SHEATH-BILL.

Legs short; tarsi scutellated; beak thick, and upon its base a hard substance which the bird has the power of raising and depressing.

FAMILY VII. GLAREOLA.

Beak short, conical, arcuated throughout and strongly cleft; wings very long and pointed; tail often forked. Legs of moderate height; external toes somewhat palmated.

FAMILY VIII. PHOENICOPTERUS, LIN. FLAMINGO.

Legs excessively long; the three anterior toes palmated to the ends, the hind one extremely short; neck not less slim, nor shorter than than the legs; head small; a beak whose lower mandible is an oval, longitudinally grooved into a semi-cylindrical canal, while the upper one, oblong and flat, is bent crosswise in its middle so as to join the other exactly. They live on Shellfish, Insects and Fish

ORDER VI. PALMIPEDES.

Feet formed for swimming, that is to say, placed far back on the body, attached to short and compressed tarsi, and palmated between the toes; plumage dense, glossy, saturated

with oil, garnished next the skin with a thick down, and intended to protect them from the water in which they live; length of neck often much exceeding that of the feet, which permits certain species to seize their food at the bottom of shallow waters; sternum very long, affording complete protection to the greater portion of their viscera, and having on each side but one emargination or oval hole furnished with membrane; gizzard generally muscular; inferior larynx simple, but in one family inflated into cartilaginous capsules. Four families.

FAMILY I. BRACHYPTERÆ.

Legs placed farther back than in any other birds, which renders walking painful to them, and obliges them to stand when on land in a vertical position; flight feeble, or none at all; plumage very dense, smooth and glossy like silver; they swim under water by the aid of their wings. Three genera.

GENUS COLOMBUS, Lin. *Diver.*

Beak smooth, straight, compressed and pointed; nostrils linear; they consume a great many fish. Three remarkable subgenera, distinguished by the form of their feet.

SUBGENUS PODICEPS, Lath. *Grebe.*

Toes widened by membranes, the anterior only united at the base; middle nail flattened.

SUBGENUS MERGUS, Briss. *Diver proper.*

Feet palmated; nails pointed; northern birds seldom breeding among us, but migrate south during winter.

SUBGENUS URIA, Briss. *Guillemot.*

No thumb; feathers as far as the nostrils; wings still shorter than those of the Divers.

GENUS ALCA, Lin. *Auks.*

Beak very much compressed, elevated vertically, trenchant towards the rear, and generally ridged across; feet entirely palmated, and wanting the thumb. [Northern Seas.]

GENUS APTENODYTES, Forst. *Penguin.*

No flight; small wings, furnished with traces of plumage,

like scales ; when standing they rest upon the tarsus, which is widened like the sole of the foot in some quadrupeds.

FAMILY II. LONGIPENNES.

Thumb small or none ; wings very long ; beak not indented, but crooked at the end in the first genera, and merely pointed in the others.

GENUS PROCELLARIA, Lin. *Petrel.*

Beak curved at the end, which appears to be formed of a piece articulated to the rest ; nostrils united in a tube upon the back of the upper mandible ; a sharp nail instead of thumb.

GENUS DIOMEDEA, Lin. *Albatross.*

Beak large, strong, trenchant, and terminated by a thick crook, which appears to be articulated there ; nostrils resembling short rolls placed upon the beak ; feet without thumbs or even small nails. ; wings very long and narrow. These are the largest sea-birds. [Southern Ocean.]

GENUS LARUS, Lin. *Gull.*

Beak compressed, elongated, pointed ; upper mandible curved at the extremity, the inferior angular and inflated ; nostrils long, narrow and open for one half the length of the beak ; tail composed of equal feathers ; legs tolerably long ; thumbs short ; the larger species are called *Goelands*, the lesser *Mouettes*.

GENUS STERNA. *Sea-Swallow.*

Wings excessively long and pointed ; tail forked ; beak pointed, compressed, straight, without curve or projection ; the nostrils situated near the base ; toes to the number of four, one behind long enough to reach the earth, three before united by emarginated membranes, causing them to swim badly.

FAMILY III. TOTIPALMATÆ.

Thumb united to the toes by one single membrane, which renders their feet complete oars when extended ; feet short ; they are the only Palmipedes who perch upon trees.

GENUS PELECANUS, Lin. *Pelican.*

Beak exceedingly long, straight, depressed and terminated by a kind of nail ; the lower mandible has flexible branches sustaining a naked membrane, which can be dilated into a more or less voluminous sac ; nostrils linear, hardly perceptible ; eyes heavy and naked like the throat.

GENUS TACHYPTETES, Vieil. *Frigate-Bird.*

No remarkable pouch ; tail forked ; feet short ; toes semi-palmate ; wings very long ; mandible short and curved at the point.

GENUS SULA, Briss. *Booby.*

Beak straight, the edges provided with teeth ; nostrils prolonged by a line which extends to near the point ; throat naked (as well as the circumference of the eyes), and little extensible ; nail of the middle toe indented like a saw ; wings moderate.

FAMILY IV. LAMELLIROSTRES.

Beak thick, clothed with a soft skin rather than with true horn, the edges furnished with small laminae or teeth ; tongue wide and fleshy, and the edges notched ; three toes before united by membranes, one behind free ; wings of moderate length ; habitation more frequently upon fresh waters than upon the sea.

GENUS ANAS, Lin.

Beak large and broad, the edges furnished with a row of projecting laminæ, placed transversely, which seem intended to let the water escape when the bird seizes its prey. Three remarkable subgenera.

SUBGENUS CYGNUS, Meyer. *Susan.*

Beak as broad before as behind ; neck very long ; nostrils in the middle of the length of the beak.

SUBGENUS ANSER, Briss. *Goose.*

Beak moderate and narrow before ; legs longer than in the *Anas proper.*

SUBGENUS *ANAS*, Meyer. *Duck.*

Beak widened and much flattened towards the end ; legs very short ; neck moderate. Some species have the thumb bordered with a membrane, others have not.

GENUS *FULIGULA*, Leach.

Beak broad and flat. The Canvass-back and Red-neck belong to this genus.

GENUS *MERGUS*.

Beak thin, cylindrical, much crooked at its extremity; mandibles with sharp teeth directed backwards ; nostrils perforated.

REPTILIA.

Reptilia are oviparous Vertebrata, with an incomplete circulation and diminished respiration, organized for creeping.

On each contraction of the heart in Reptiles, only a part of the blood received from the system is thrown into the lungs, and therefore only that portion is exposed to the action of the atmosphere. It results from this that the respiration is less than in the preceding divisions, consequently the heat of the blood is less, and they are called cold-blooded animals ; their muscular energy is less ; digestion slower ; sensations more obtuse ; and in cold climates they pass the winter in a state of torpor.

The brain is small in proportion to the size of the animals, and their sensations do not appear to be referred to the brain as a common centre, since they live and move after the loss of the brain and even after the removal of the head.

The external covering of the body is composed of scales or naked skin, as on account of their blood being cold they do not require to be protected against the loss of temperature. Their eggs are not hatched by the parents, but generally by the influence of solar heat.

ORDER I. CHELONIA.*

Body oval, short, enclosed in a solid shell, covered by skin, or with large scales; the upper part of the shell, composed of dorsal vertebræ and ribs (as many as eight pair) spread out and united together, is denominated the *carapax*; the under part, formed generally of nine pieces, constitutes a true sternum, and is called the *plastron*. A kind of frame surrounds the carapax and joins it to the plastron at the sides; it is composed of a series of pieces, which appear to represent the sternal portion of the ribs. The scapula and bones of the pelvis, instead of being attached to the ribs and dorsal spine, are attached beneath, so that the Tortoise may be considered as an inverted animal. The vertebral extremity of the scapula is articulated with the carapax; the inferior extremity with two bones, of which one is analogous to the coracoid apophysis of Birds and remains free, the other, representing the clavicle, is united to the plastron; so that the two shoulders form a ring through which pass the cesophagus and trachea; jaws covered with horn as in Birds; no teeth; heart composed of two auricles and of only one ventricle, with two unequal communicating chambers. Four remarkable genera.

GENUS I. TESTUDO, Brog. *Land Tortoise.*

Feet adapted for walking; legs as if truncated, with very short toes closely joined as far as the nails, of which there are five before and four behind.

GENUS II. EMYS, Brog. *Fresh-Water Tortoise.*

Toes more widely separated than in the preceding, and more or less palmated; carapax usually more flattened than in the former.

GENUS III. CHELONIA, Brog. *Sea Tortoise.*

Feet elongated and flattened in the form of fins; toes closely united in a single membrane; shell too small to receive the head and feet.

* Tortoises.

GENUS IV. TRIONYX. *Soft Tortoise.*

No scales; merely a soft skin to envelope their carapax and plastron.

ORDER II. SAURIA.

Heart like that of the Cheloniæ; ribs movable, partially connected with a sternum, and serving for respiration; lungs more or less extended towards the posterior extremity of the body; skin covered with scales or hard granulations called *shagreen*; mouth always armed with teeth; toes generally provided with nails; tail more or less long; most usually four legs, sometimes only two; eggs enveloped in a hard and calcareous shell. Six families.

FAMILY I. CROCODILIDA.

Animals of large size; tail flattened laterally, which renders them aquatic; four limbs; five toes before, four behind, more or less palmated; only the three internal ones armed with claws; a single row of pointed teeth in each jaw; tongue fleshy and flat, and adhering close at its edges; the back and tail covered with large square scales, relieved by a ridge along their middle; those of the abdomen fine and smooth; a crest with strong indentures on the tail, double at the base; ventricle of the heart divided into two chambers, made distinct by a complete partition; instinct carnivorous; habitation in fresh waters. Three genera.

GENUS I. CROCODILUS, Briss. *Crocodile proper.*

The fourth tooth of the under jaw passing into a notch of the upper jaw; teeth of unequal size; muzzle moderate and depressed horizontally; toes of posterior limbs entirely palmated. [Both Continents.]

GENUS II. GAVIAL, Cuv.

The fourth tooth of the under jaw passing into a notch of the upper; teeth equal; muzzle long, slim and cylindrical; toes of the posterior limbs entirely palmated. [The old continent only.]

GENUS III. *ALLIGATOR*, Cuv.

The fourth tooth of the under jaw entering into a hole in the upper; toes of posterior limbs semi-palmated. [America only.]

FAMILY II. LACERTINIDA.

Tongue extensible and terminated in two threads; five free toes on each foot, unequal and armed with nails; scales of the abdomen and top of the tail arranged in transverse bands. Two remarkable genera.

GENUS I. MONITOR.

Large size; tail flattened laterally; teeth to the jaws, not to the palate.

GENUS II. *LACERTA*. *Lizard proper*.

Extremity of the palate armed with two rows of teeth; a collar under the neck formed of large scales; a casque formed by the projection of the cranium over the orbits.

FAMILY III. IGUANIDA.

All the characteristics of the second family except that the tongue is not extensible. Two remarkable genera.

GENUS I. AGAMA, Daud.

Head enlarged behind; no teeth in the palate; scales of the tail imbricate; spines on different parts of the body, especially near the ear; skin of the throat loose and susceptible of inflation; some have femoral pores, others none.

GENUS II. DRACO, Lin. *Dragon*.

No teeth in the palate; the six first false ribs, instead of investing the abdomen, extend in a straight line and support a fold of the skin of the sides, forming a parachute; scales imbricate.

GENUS III. IGUANA, Cuv.

Teeth on the palate; ribs formed in the ordinary manner; a range of recurved scales all along the back; a dewlap under the throat. [America.]

FAMILY IV. GECKOTIDA.

Form heavy; aspect hideous; five toes widened through a part or through the whole of their length, so as to allow of their sustaining themselves, like flies, with the feet up; in most the nails are retractile; eyes large, pupil contracting on the approach of light; life nocturnal. One genus, *Gecko*, Daud.

FAMILY V. CHAMÆLEONIDA.

The back, if it may be so expressed, trenchant; skin granulated; five toes on each foot, divided into two bundles opposable to each other; tail prehensile; tongue issuing from the mouth in the form of a worm; an enormous development of the lungs, which enables the animal to change colour and even renders it, when the lungs are full, nearly transparent; live upon insects. One genus, *Chamælio*.

FAMILY VI. SCINCOIDEA.

Feet short; tongue not extensible; scales equal and imbricated upon the body and tail.

GENUS I. SEPS, Daud.

Body much elongated; feet small; lungs unequal.

GENUS II. BIPES, Lacep.

Fore feet entirely wanting; the hind feet alone visible; rudiment of a shoulder beneath the skin.

GENUS III. CHIROTES, Cuv.

No hind feet; fore feet alone visible.

ORDER III. OPHIDIA.

Body extremely elongated, entirely without limbs, moving itself by means of the folds it makes while in contact with the ground; vertebral column very movable, composed of a vast number of vertebrae supporting themselves; a great

number of ribs, employed in respiration ; no sternum nor movable eyelids, nor tympanum ; tongue very extensible, terminated by two long movable points of a consistence nearly like horns, and contained, while at rest, in a membranous case ; the mouth furnished with teeth fit only to retain the prey ; heart with two auricles; and only one ventricle ; only one lung, extending far towards the posterior portion of the body ; voice, when any, consisting in a dull hiss ; eggs agglutinated in the form of a chaplet, and quite soft, although enveloped in a calcareous substance. Three families.

FAMILY I. ANGUINA.

Three eyelids ; imbricated scales over all the body ; most usually the rudiment of a shoulder or pelvis under the skin.

FAMILY II. SERPENTIA.

No sternum nor vestige of shoulder ; no third eyelid nor tympanum. In this family are comprised the greater part and the most singular of the Ophidia. Two tribes.

TRIBE I. AMPHIISBENA.

Mouth not dilatable ; head uniform with the body, permitting them to walk equally well backwards or forwards ; body covered with scales.

TRIBE II. SERPENS PROPER.

Jaw so arranged as to permit a wide opening of the mouth ; the two branches are not soldered, and can separate laterally ; the tympanal bone to which they are attached is itself suspended to another bone articulated to the cranium ; the two upper maxillary bones preserve also their mobility ; besides the teeth of the jaws there is a double range in the palatine arches. Two sections.

Section I. Non-Venomous.

No movable teeth either with channel or tube ; all are fixed strongly ; in the roof of the mouth four rows nearly equal, two below. Two genera.

GENUS I. BOA, Lin.

Under part of the tail and body furnished with a simple uninterrupted band of scales; body compressed; two hooks near the extremity; tail prehensile.

GENUS II. COLUBER, Lin.

Plates beneath the tail, arranged in pairs. Two subgenera. The subgenus *Python* is of great size, and has hooks near the extremity; the subgenus *Coluber proper* is of small size, has no hooks, and large plates upon the head.

Section II. Venomous.

A gland placed under the eye secretes a poison, and discharges it by a canal, whose extremity opens into a duct or gutter channelled in certain teeth of the upper jaw called movable fangs; the animal, at will, can conceal them in a fold of the gum; besides these there are, in the upper jaw, two ranges of palatine teeth. Two genera.

GENUS I. CROTALUS, Lin.

Rattles at the extremity of the tail, as many as seven or eight, very rarely ten. A small rounded pit behind each nostril. [America.]

GENUS II. VIPERA, Daud.

No rattles at the extremity of the tail nor rounded indentation behind each nostril. Two subgenera.

SUBGENUS VIPER PROPER.

Small granulated scales on the top of the head.

SUBGENUS NAIA.

Head furnished with plates; anterior limbs susceptible of being raised up and drawn forwards, so as to dilate this part of the body into a disk more or less broad.

FAMILY III. NUDA.

Consist of a single genus.

CŒCILIA, Lin.

So called because their eyes are so small as even to seem to be wanting; scales so small that the skin appears to be

entirely naked. To this genus belongs the common Orvet or Slow Worm.

ORDER IV. BATRACHIA.

No carapax, nor scales, nor nails; body covered with a naked skin; limbs most generally; a heart with two auricles and one ventricle; two equal lungs, to which, at first, are added branchiæ supported on each side of the neck by cartilaginous arches. The greater part lose these branchiæ and the apparatus which supports them in passing from the condition of Fish to that of Reptile. Three genera—among which are the Protei—retain them for life. Eggs enveloped in a simple membrane, and becoming greatly enlarged in the water. Two families.

FAMILY I. RANA. FROG.

Four legs, but no tail, in their perfect state. Head flat; muzzle rounded; opening of the jaws wide; anterior feet short, terminated by four toes; the posterior longer and frequently having six. In the greater part there is a soft tongue not attached to the bottom of the gullet, but to the edges of the jaw, and folding inwards. Skeleton without ribs; inspiration being effected by a motion of deglutition, expiration by a contraction of the abdominal muscles. The young, which issues from an egg, is called a *Tadpole*; it is provided with a long fleshy tail, and with a little beak of horn; and its only limbs are small fringes at the side of the neck which disappear at the end of a few days. Respiration is effected by branchiæ affixed to the hyoid bone; the water which enters the mouth and traverses them, issues by one or two openings. At a certain period these organs decay; the horny beak falls; the intestines become shortened; to the herbivorous regimen succeeds a carnivorous one; the tail is insensibly absorbed; the legs perceptibly develop themselves, the hind ones appearing sooner than the anterior, which grow beneath the skin. Four remarkable genera.

GENUS I. RANA, Lin. *Frog proper.*

Skin smooth; body tapering; hind feet very long and more or less palmated; a row of small teeth all round the upper jaw; under each ear, in the males, a fine membrane, which becomes inflated when they cry out; these animals swim and leap very well.

GENUS II. HYLA, Laur. *Tree-Frog.*

Same characteristics as the frogs; the only difference lies in a kind of rounded viscous pellet placed upon each toe, and which enables them to adhere to the smoothest bodies, and to run upon the leaves of trees with the feet upwards.

GENUS III. BUFO, Laur. *Toad.*

A thick bulky body; skin covered with warty excrescences; hind legs short; a thick lump, pierced with pores, behind the ears, which emits a milky, fetid humour. No teeth.

GENUS IV. PIPA, Laur.

Body flattened horizontally; head triangular; no tongue; each of the fore toes divided into four small parts at the extremity; the species best known inhabits South America, and presents a very remarkable phenomenon. The male places the eggs upon the back of the female who repairs to the water; the skin of the back there swells and forms little cells, where the young inclose themselves during the metamorphosis.

FAMILY II. SALAMANDRA.

Four feet; a tail as in the Lizards; very small ribs; in the adult state, respiration as in the Ranæ, except in three genera, where branchiæ exist through life; branchial arches in the Tadpole inclosed in a tunic, and floating externally; fore feet appear before the hind ones.

GENUS I. SALAMANDRA, Laur. *Terrestrial Salamander.*

In the perfect state, tail round; four toes before, generally five behind; existence as a Tadpole brief.

GENUS II. TRITON, Laur. *Aquatic Salamander.*

Tail compressed at the sides; astonishing power of repro-

duction exhibited in the formation of new limbs in the place of those cut or torn off.

GENUS III. PROTEUS, Laur.

True Amphibia on account of the double use of lungs and branchiæ throughout life.

PISCES.

Fish are oviparous Vertebratæ with a double circulation, and organs of respiration adapted to the element in which they live. The respiration is performed by means of *branchiæ* (gills) situated on each side of the neck, composed of numerous *laminæ* covered with small blood vessels. The air in the water which passes through these *laminæ* acts upon the blood which is constantly arising from the heart. The heart consists of one auricle and one ventricle which transmit the blood to the *branchiæ*; from thence it is conveyed into an artery situated under the spine. This vessel acts like the left ventricle in Mammalia and distributes the blood to all parts of the system to be returned by the veins to the heart.

The structure of Fish is well adapted for swimming, and this is facilitated in a number of species by an air bladder immediately under the spine. The tail is the principal instrument in progression. The organs analogous to limbs are much reduced, and are represented by *rays* which support membranous fins. Those fins which correspond to the fore limbs are called *pectoral*, to the hind ones *ventral*, those situated on the back *dorsal*, those below *anal*, and those at the end of the tail *caudal*. The rays are either hard and pointed, consisting of a single piece divided through its length, when they are called *spinous*; or they consist of a number of pieces articulated together, called *articulated rays*.

The head varies in form, but consists of the same number

of bones as in other Ovipara, each bone being divided into several pieces. In the greater number the *intermaxillary* bone forms the margin of the upper jaw, having behind the *maxillary* or *labial* bone. A palatine arch composed of the process of several bones forms a sort of anterior jaw, and affords, behind, an articulation for the lower jaw, which usually consists of two mandibular bones on each side. The hyoid bone has rays on each side for the support of the branchiæ. These latter are covered by three bony pieces as a sort of lid, the *operculum*, the *suboperculum*, and the *interoperculum*, so as to close the great opening of the gills; these three united play upon a fourth, the *præoperculum*.

This class may be divided into Fishes Proper or Bony Fishes, and the Chondropterygii or Cartilaginous Fishes.

Series I. Bony Fishes.

ORDER I. ACANTHOPTERYGII.

Spines occupying the place of the first rays of the dorsal, or alone sustaining the first fin of the back where there are two; some spines to the *anal*; generally one to each *ventral*. The mobility of the upper jaw and the disposition in combs of the branchiæ distinguish them from the Plectognathi and the Lophobranchii. Fifteen families, of which we give the four most remarkable.

FAMILY I. PERCOIDES.

Body oblong and covered with scales, generally hard and rough; operculum or *præoperculum*, often both, with denta-
ted or spinous edges; the jaws, the fore part of the *vomer*, and generally the palatine bones, furnished with teeth. Three divisions.

The first have the *ventrals* inserted under the *pectorals*, and forming a division which may be called *Thoraci-Percoides*. Two remarkable genera.

GENUS I. PERCA, Cuv. *Perch.*

Ventral fins under the pectorals; two dorsals; seven branchial rays; all the teeth *en velours* (so small and close together as to resemble the pile of velvet); bony operculum terminating in two or three sharp points; praéoperculum dentated; tongue smooth.

GENUS II. LABRAX, Cuv.

Differ from the Perca in having scaly opercula terminating in two spines; tongue rough. Includes the Rock Fish of America.

Another division have the ventrals placed more forward than the pectorals; they are called *Jugulares*. The most remarkable genus of which is the

URANOSCORPUS, Lin. *Star Gazers.*

Eyes placed at the upper surface of the head, and look upwards; mouth vertical.

The third division have the ventrals farther back than the pectorals. They constitute the *Abdominales*.

MULLUS. *Mullet.*

Ventrals to the rear; pelvis not suspended to the shoulder; three rays to the branchiæ; praéoperculum not dentated; two long cirri (beards) hanging from the under jaw.

FAMILY II. ACANTHOPTERYGII,

WITH MAILED CHEEKS.

Aspect of the head singular, being variously bristled and plated; the suborbital bones more or less extended upon the cheeks. Two remarkable genera.

GENUS I. TRIGLA, Cuv.

Three rays, free, and spread out under the pectoral fin, but not sufficiently developed to sustain them in the air.

GENUS II. DACTYLOPTERUS, Lacep. *Flying Fish.*

Under rays of the pectoral very numerous and united by a membrane, so as to form an additional pectoral longer than

the fish itself, and capable of sustaining it in the air for a considerable time.

FAMILY III. SCOMBEROIDES.

Scales small; body smooth; tail and caudal fin very vigorous. Three remarkable genera.

GENUS I. SCOMBER. *Mackarel.*

Two small cutaneous crests on the sides of the tail; an empty space between the two dorsals; five false fins above and below.

GENUS II. THYNNUS. *Tunny.*

A kind of corselet around the throat, formed by scales larger and smoother than those of the rest of the body; nine false fins above and below.

GENUS III. XIPHIAS. *Sword-Fish.*

A beak or long point, in the form of a sword or spit, terminating the upper jaw, and forming a powerful weapon.

FAMILY IV. ACANTHOPTERYGII,

WITH LABYRINTHIFORM PHARYNGEALS.

The superior pharyngeals divided into small lamellæ, more or less numerous, irregular, intercepting cells in which the water remains to flow upon and moisten the branchiæ while the fish is removed from its element. This permits it to seek the land and crawl to a considerable distance from the water; a singular faculty, which gave rise to the Indian belief that these animals fell from heaven.

ORDER II. MALACOPTERYGII ABDOMINALES.

Upper jaw movable; branchiæ in combs; rays of the fins generally cartilaginous; ventrals suspended under the abdomen and behind the pectorals, without being attached to the bones of the shoulder. A numerous order, comprising the greater part of Fresh-water Fishes. Five families.

FAMILY I. CIPRINIDÆ.

Mouth slightly cloven; jaws weak and generally without teeth; pharyngeals deeply indented, to compensate for the trifling armature of the jaws; body scaly; no adipose dorsal; these are the least carnivorous of fish. Only one remarkable genus.

GENUS CYPRINUS, Lin. *Carp.*

Tongue smooth; the palate provided with a thick, soft and singularly irritable substance, commonly known by the name of "Carp's tongue;" pharynx presenting a powerful instrument of mastication; only one dorsal; body scaly; they inhabit fresh water, and are the least carnivorous of their class; they live on herbage, grain and even ooze. Seven remarkable subgenera.

SUBGENUS I. CIPRINUS, Cuv. *Carp proper.*

Dorsal long, in which, as well as in the anal, is a spine more or less stout, in place of the second ray; some have cirri, others are without them.

SUBGENUS II. BARBUS, Cuv.

Dorsal and anal short; a strong spine in place of the second or third ray of the dorsal; four little beards (cirri), of which two are upon the end and two at the angles of the upper jaw.

SUBGENUS III. GOBIO, Cuv. *Gudgeon.*

Dorsal and anal short, without spines; cirri.

SUBGENUS IV. TINCA, Cuv. *Tench.*

Characteristics of the Gudgeons, but very small scales and cirri.

SUBGENUS V. LEUCISCUS, Klein.

Dorsal and anal short; no spines nor cirri.

SUBGENUS VI. CATOSTOMUS, Leseur.

Dorsals short and opposite to the ventrals; lips fleshy, hanging and fringed or crenated; inhabit the fresh waters of North America.

SUBGENUS VII. *PACILIA*, Schn.

Have the jaws horizontally flattened, protractile, slightly cleft, armed with a row of very small teeth; operculum large; five rays to the branchiæ; ventral but little way back; the dorsal above the anal; small fish of the fresh waters of America.

FAMILY II. ESOCES.

No adipose fin; the edge of the upper jaw formed by the intermaxillary, or when not so formed the maxillary is without teeth and hidden by the lips; instinct voracious; many of them ascend rivers.

GENUS I. *Esox*, Cuv. *Pike*.

Muzzle oblong, obtuse, wide and depressed; one dorsal opposite the anal; nearly all the mouth, besides the jaws, bristled with teeth.

GENUS II. *EXOCETUS*, Lin. *Flying-Fish*.

Excessive length of the pectoral fins, which are sufficiently extended to support them some time in the air. Their flight is never very long; they rise to avoid voracious Fishes, but soon fall, as their wings merely serve as parachutes. Dorsal placed above the anal; branchial rays ten.

FAMILY III. SILURIDÆ.

No true scales; a naked skin or large osseous plates; almost always the dorsal and pectoral have a strong articulated spine instead of the first ray; frequently an adipose one behind. Those of the genus *Silurus* are commonly called Cat-Fish.

FAMILY IV. SALMONIDES.

Body scaly; the first dorsal with soft rays, followed by a small adipose one, that is to say one formed simply of a fold of the skin filled with fat and unsupported by rays.

GENUS I. *SALMO*, Cuv. *Salmon proper*,

Or Trout, have interior of the mouth more completely armed than in any other Fish; their natatory bladder extends from one end of the abdomen to the other. Body almost always

spotted. Ventrals opposite to the middle of the dorsal. Adipose opposite the anal; branchial rays about ten.

GENUS II. OSMERUS, Artedi. *Smelt.*

Mouth not so well armed as in the Salmon; body without spots; ventrals corresponding with the anterior edge of the first dorsal; branchial rays eight. They are found in the sea at the mouth of large rivers.

FAMILY V. CLUPEÆ.

No adipose fin; body scaly.

GENUS I. CLUPEA, Cuv. *Herring proper.*

Intermaxillaries very short, forming but part of the upper jaw, the sides of which are formed by the maxillaries; branchiæ deeply cleft, sides of the branchial rays comb-like; mouth moderate; upper lips not notched.

GENUS II. ALOSA, N. *Shad.*

An emargination in the upper jaw.

GENUS III. ENGRAULIS, Cuv. *Anchovy.*

Mouth cleft far behind the eyes; branchiæ still more open than in the Herring; rays twelve or more.

ORDER III. MALACOPTERYGII SUBRACHIATI.

Ventrals attached under the pectorals. Pelvis immediately suspended to the bones of the shoulder. Two remarkable genera.

GENUS I. GADUS, Lin.

Recognizable by the sharp-pointed ventrals attached to the throat. A slightly elongated compressed body, covered with soft scales; head without scales, fins soft, jaws and front of the vomer armed with unequal pointed teeth in many rows; branchiæ large, with seven rays; two or three dorsal, one or two anal and a distinct caudal. Inhabit cold and temperate seas and form important fisheries.

SUBGENUS MORRHUA, Cuv. *Cod*

Three dorsal fins; two anals; a cirrus at the point of the lower jaw.

SUBGENUS MERLANGUS. *Whiting.*

The same number of fins as the Cod, but no cirrus.

SUBGENUS MERLUCCIUS, Cuv. *Hake.*

Two dorsals; only one anal; no cirrus.

GENUS II. PLEURONECTES, Lin.

Commonly called Flat Fish, have a character unique among vertebrated animals, consisting in the want of symmetry in the head, where both eyes are on one side, which remains uppermost while the animal is swimming, and which is always deeply coloured, while that in which the eyes are wanting is whitish. The rest of the body participates a little in this irregularity. The two sides of the mouth are not equal, and the pectorals rarely so. The body is strongly compressed and vertically elevated. The dorsal extends throughout the length of the back; the anal occupies the under part of the body, and the ventrals almost seem to continue it before while they are in fact often united with it. There are six rays to the gills, and no natatory bladder; they seldom quit the bottom of the water. Three remarkable subgenera.

SUBGENUS I. PLATESSA, Cuv. *Plaice.*

A range of obtuse trenchant teeth in each jaw; generally teeth *en pavés* to the pharyngeals (arranged like paving stones). The dorsal only advances as far as the top of the other eye, and leaving, as well as the anal, an interval between it and the caudal. Generally eyes on the right.

SUBGENUS II. RHOMBUS, Cuv. *Turbot.*

Teeth small and crowded, like those of a card, in the jaws and pharynx; dorsal advancing towards the edge of the upper jaw, and extending, as well as the anal, to very near the caudal; eyes almost always to the left.

SUBGENUS III. SOLEA, Cuv. *Sole.*

Mouth twisted, and as if distorted, to the side opposite the eyes, and furnished on this side only with teeth *en velours*

(very minute and crowded), while the side of the eye is deprived of teeth ; dorsal commencing at the mouth and extending, as well as the anal, to the caudal.

ORDER IV. MALACOPTERYGII APODES.

Form elongated ; skin thick and soft, presenting but little appearance of scales ; few bones ; no ventral fins. Two remarkable genera.

GENUS MURÆNA, Lin.

Small opercula concentrically surrounded by rays, and enveloped, as well as these latter, in the skin, which only opens at a considerable distance back by a species of tube. Two remarkable subgenera.

SUBGENUS ANGUILLA, Cuv. *Eel.*

Gills opening on each side under the pectoral fins ; the dorsal and caudal forming by their union a pointed caudal ; dorsal commencing at a considerable distance behind the pectorals.

SUBGENUS CONGER, Cuv.

Dorsal commencing near the pectorals ; upper jaw longest ; same characteristics as in the Eel.

GENUS GYMNNOTUS, Lin.

Gills partially closed by a membrane, but which opens before the pectorals ; anal extending generally to the end of the tail ; no dorsal.

ORDER V. LOPHOBRANCHII.

Jaws complete and free ; branchiæ, instead of having the form of a comb, are divided into small round tufts arranged in pairs along the branchial arches, and concealed under a large operculum tied down on all sides by a membrane, which leaves only a small orifice for the escape of the water ; bran-

chial rays hardly apparent; body of small size, and plated from one end to the other with laminæ, which generally render it angular. Two remarkable genera.

GENUS SYNGNATHUS, Lin.

A tubular snout terminated by an ordinary mouth split vertically; no ventrals; the eggs slip into a pouch placed under the abdomen or tail, and which splits open for the passage of the fry.

SUBGENUS HIPPOCAMPUS, Cuv.

Trunk compressed laterally, and considerably more elevated than the tail; by curving after death the head and body take the semblance of the chest of a horse in miniature; the joints of the scales are elevated into ridges, and their salient angles into spines; no caudal fin.

GENUS PEGASUS, Lin.

Mouth opening beneath the base of the snout; body mailed; trunk wide and depressed; pectoral often very large, whence they derive their name; dorsal and anal opposite each other. [Indian Ocean.]

ORDER VI. PLECTOGNATHI.

Maxillary bone soldered, or firmly attached, to the sides of the intermaxillary, which alone constitutes the jaw; palatine arch connected by a suture with the cranium, and deprived of mobility; opercula and rays concealed under a thick skin, leaving visible only a small branchial fissure; mere vestiges of ribs; no true ventrals; natatory bladder considerable. Two families.

FAMILY I. GYMNODONTES.

Jaws furnished, instead of apparent teeth, with an ivory substance internally divided into laminæ, whose *ensemble* resembles the beak of a Parrot, and which, in fact, consists of true teeth united, succeeding each other as fast as they are destroyed by trituration. One remarkable genus.

GENUS DIODON, Lin.

Jaws undivided, and presenting only one piece above and another below, behind the trenchant edge of which is a round portion transversely furrowed, and forming a powerful instrument of mastication ; skin armed on all sides with thick pointed spines, so that when inflated they resemble the burr of a chestnut tree. They can also swell themselves out by filling their stomach with air, or rather a sort of fine and extensible crop, which occupies the whole length of the abdomen.

FAMILY II. SCLERODERMI.

Snout conical or pyramidal, prolonged from the eyes, and terminated by a small mouth armed with a few distinct teeth in each jaw ; skin generally rough or covered with hard scales. One remarkable genus.

GENUS OSTRACION, Lin.

In place of scales bony and regular compartments, soldered as in a cuirass, permitting no free movement except to the tail and fins, which pass through the holes of this corselet.

Series II. Chondropterygii. Cartilaginous Fishes.

Skeleton consisting of a mere homogeneous and semitransparent cartilage, which is invested only at the surface, in the genera *Raia* and *Squalus*, with a bed of small, opaque, circular grains, arranged one against the other and not in threads or filaments.

In the *Lampreys* the skeleton has not even this envelope ; and, in the *Ammocetes*, it remains absolutely membranous.

The most apparent characteristic of this division of the class of Fishes is the absence of maxillary and intermaxillary bones ; or rather in their only having vestiges of them under the skin, while their functions are fulfilled by bones analogous to *palatines*, and sometimes even by a *vomer*. Three orders.

ORDER I. STURIONES.

Branchiæ free at their external edge; a single orifice very open in each operculum; no rays to the membrane. One remarkable genus.

GENUS ACIPENSER, Lin. *Sturgeon.*

Body elongated and more or less covered with bony plates implanted upon the skin in longitudinal rows; the exterior portion of the head also well mailed; mouth placed under the snout, small and without teeth; eyes and nostrils in the sides of the head; cirri under the snout; dorsal behind the ventrals and beneath it; caudal surrounding the extremity of the spine, and having a salient lobe beneath shorter than its principal point. These enormous Fishes are not only inhabitants of the ocean but likewise nearly all the northern rivers of the old and new world. Norway produces some of a thousand pounds weight. In old Rome a respect approaching to worship was paid them, and they were borne in triumph through the streets.

ORDER II. SELACHII.

Branchiæ fixed on both edges, and letting the water escape by as many holes pierced in the skin as there are intervals between them; the ordinary bones of the jaw reduced to mere vestiges; the bones which succeed, the palatines above and postmandibularies below, alone armed with teeth; branchiostegal rays not apparent externally; no operculum; pectorals and ventrals; the latter placed behind the abdomen. Three remarkable genera.

GENUS I. SQUALUS, Lin. *Shark.*

Body elongated; tail thick and fleshy; pectorals of moderate size; form approaching that of ordinary Fishes; branchial openings; eyes upon the sides of the head and neck; snout sustained by three cartilaginous branches connected with

the anterior part of the cranium; small branchial ribs apparent.

GENUS II. PRISTIS, Lath. Saw-Fish.

Uniting with the form of the Shark a body flattened before; branchiæ opening below as in *Raia*, and a very long snout or depressed beak, like the blade of a sword, armed on each side with strong, bony, trenchant and pointed spines; this weapon enables them to attack the largest Cetacea.

GENUS III. RAIA, Lin. Ray.

Body flattened horizontally, and resembling a disk on account of its union with the exceedingly broad and fleshy pectorals joined with each other to the snout, or before it, and which extend behind the two sides of the abdomen to near the base of the ventrals; eyes on the dorsal surface as well as *vents* (two openings which communicate with the branchial cavity and supply it with water, when the gullet of the animal is filled with prey); mouth, nostrils and branchial orifices on the ventral surface; dorsals almost always on the tail.

ORDER III. SUCTORII.

Mouth in a ring; skeleton more imperfect than in any other vertebrated animal; neither pectorals nor ventrals; body elongated and terminated before by a fleshy lip, circular or semicircular, sustained by a cartilaginous ring, arising from the soldering of the palatines to the under jaw; the branchiæ, instead of combs, present the appearance of purses, formed by the union of one face of a branchia with the opposite one of its neighbour. One remarkable genus.

GENUS PETROMYZON, Dumer. Lamprey.

Seven branchial openings on each side; skin of the tail, above and beneath, turned up into a longitudinal crest, which supplies the place of a fin, but in which the rays are hardly distinguishable fibres; two dorsals, the posterior one joining the caudal; maxillary ring armed with very strong teeth;

tubercles covered with a very hard shell, and resembling teeth, garnishing the inner disk of the lip, which is very circular; tongue with two longitudinal rows of small teeth, and moving backwards and forwards like a piston, producing a suction, by means of which the Fish attaches itself to rocks and other solid bodies, and even to other Fish, whom they finally pierce and devour. Lampreys are highly esteemed by epicures. In ancient Rome an extraordinary price was paid for them, and satirists reproached the rich for their extravagance in this respect. In the year 1600 a lamprey would bring ten or even twenty pieces of gold.

Second Great Division of the Animal Kingdom.

ANIMALIA MOLLUSCA.

MOLLUSCA have no articulated skeleton or vertebral canal. Their nervous system consists of a number of medullary masses, which are named according to their location in different parts of the body. The principal one is called the brain, and is situated transversely on the oesophagus, which it envelopes with a nervous collar ; organs of motion, circulation and respiration various. The circulation is always double, being assisted by an aortic ventricle seated between the veins of the lungs and the arteries of the body ; blood white or bluish.

Nearly all the Mollusca have a development of skin called a *mantle* ; this is either membranous or fleshy as in the naked Mollusca, or it has developed in its thickness a substance more or less hard, arranged in layers : when this substance becomes so much developed that the animal finds shelter beneath it, it is called a *shell*, and the animal is called *testaceous*.

All modes of mastication and every variety of digestive apparatus is to be found in this class. They most generally have a large liver.

Their muscles are attached to different parts of the skin, so as to produce various inflections, contractions or prolongations of the body, by means of which they creep or swim.

Explanation of Fig. A, Pl. 29. The nervous system of an Octopus : 1, the brain ; 2, the nervous collar around the

œsophagus ; 3, optic ganglions ; 4, lateral ganglions ; 5, abdominal ganglion.

Fig. B., Pl. 29. Anatomy of an Acephala : 1, the mouth followed by the stomach and intestines ; 2, the liver ; 3, the heart ; 4, the aorta ; 5, the branchiæ ; 6, the muscular apparatus ; 7, extension of the mantle in the form of a tube.

CEPHALOPODA.

Having the most complicated organization of all the Mollusca ; head rounded and provided with two large eyes very similar to those of the vertebrated animals ; apparatus of hearing situated in two little cavities, one on each side of the head, without external meatus or semicircular canal, and inclosing a membranous sac, in which is suspended a small stone ; mouth armed with strong horny jaws, like the beak of a Parrot ; about its opening long fleshy arms, extremely vigorous, capable of being flexed in every direction, and provided with *suckers*, by means of which they attach themselves very firmly to the objects which they embrace ; the rest of the body inclosed in a kind of sac ; branchiæ receive the venous blood under the influence of the contractions of two fleshy ventricles situated at the base of each ; aortic heart composed of one ventricle only ; stomach extremely complicated ; a peculiar gland secretes a blackish humour, which they employ in tinting the water of the sea for the purpose of concealing themselves, and which is kept in a pouch diversely situated according to the species.

GENUS I. OCTOPUS, Lam. *Polypus*.

Sack without the fins ; rudiments of a small dorsal, consisting in two little grains of a horny substance, on the two sides, of the thickness of the back ; eight feet, nearly equal, very large in proportion to the body, and united at base by a membrane ; the animal uses them in crawling and seizing its

prey ; their length and strength make them formidable weapons, by whose means it entwines itself around other animals, even destroying men while bathing.

GENUS II. ARGONAUTA. *Argonaut.*

No cartilaginous granules on the back ; the pair of feet nearest the back susceptible of dilatation, at their extremity, into a large membrane ; a very thin shell, symmetrically fluted, spirally convoluted, and somewhat the figure of a shallop ; consequently the animal, when the sea is calm, uses it as a boat, employing six of its tentacula as oars, and uplifting the two, which are spread out as sails. If the sea becomes rough, or an enemy appears, the sails and oars are instantly drawn within the shell, and the shallop sinks.

GENUS III. SEPIA. *Cuttle-Fish.*

Body contained in a sac bordered throughout its length by a narrow fin, and inclosing in the back a shell formed of an infinity of very small, fine, calcareous laminæ ; mouth surrounded with ten arms, of which two are much longer than the rest, and have suckers at the extremity only.

GASTEROPODA.

This is a class including a great number of Mollusca of which an idea may be obtained from the Slug and the Snail. Locomotion effected by the aid of a fleshy disk placed under the abdomen ; head more or less distinct and situated anteriorly, and furnished with very movable appendages (*tentacula*) placed above the mouth, and which are the seat of touch, perhaps of smell ; eyes very small, sometimes entirely wanting, sometimes adhering to the head, sometimes fixed at the base, side or point of the tentacula ; respiratory organs of

various forms, and upon which depends the division of these animals into eight orders. We give the three principal.

ORDER I. PULMONEA.

Respiration effected in a cavity the narrow orifice of which they open and shut at pleasure; no branchiæ; a net-work of pulmonary vessels creeps over the parietes of the respiratory cavity. Some inhabit the earth; others the water; the latter are obliged to rise occasionally to the surface, and open the orifice of their pectoral cavity to breathe. Two remarkable genera.

GENUS I. LIMAX, Lin. *Slug.*

Naked semi-cylindrical Mollusca; the skin forming a shield upon the back containing often the rudiments of a shell; pulmonary orifice at the right side of this buckler. Three remarkable subgenera.

SUBGENUS I. LIMAX PROPER, Lam.

Body generally elongated, and provided, in some cases, with a small oblong and flat shell, or with a calcareous concretion; orifice of the respiratory cavity at the right side of this species of buckler; four tentacula susceptible of protraction and retraction by evolving like the fingers of a glove; in the mouth a single jaw in form of a dentelated crescent.

SUBGENUS II. VAGINULUS, Ferus.

Mantle dense, without shell, and extending over the whole length of the body; four tentacula. [East and West Indies.]

SUBGENUS III. TESTACELLA, Lam.

Mantle very small, placed upon the posterior extremity, containing a small oval shell with a very wide aperture, and a very small spire; this shell is not the tenth part of the body in length.

GENUS II. HELIX, Lin. *Snail.*

Shell complete, apparent and globular; the opening a little encroached upon by the projection of the penultimate turn of the spire, and circumscribed in the form of a crescent. The

Romans bred them in parks, and fattened them for food; the most esteemed came from Sicily and Africa. Snails breed in all parts of the world; moist localities are those in which they assemble, through preference, during summer; in winter they bury themselves in the earth, or under walls, and the bark of trees.

ORDER II. NUDIBRANCHIATA.

No shell nor pulmonary cavity; branchiæ exposed upon some parts of the back. They are all marine animals, frequently swimming in a reversed position, making the surface of the feet concave like a boat, and aiding themselves with the edges of their mantle and their tentacula as with oars. Only one remarkable genus.

GENUS DORIS, Cuv.

Branchiæ arranged in a circle on the posterior part of the back, under the form of little arbusculæ, composing altogether the appearance of a flower. They are found in all seas. Their ova resemble gelatinous bands spread upon rocks and marine plants.

ORDER III. PECTINIBRANCHIATA.

Respiratory organs consisting almost always of branchiæ, composed of laminæ, united in the form of combs, and concealed in a dorsal cavity with a wide opening on the side of the head. Almost all have turbinated shells, with the mouth entire or provided with a syphon, and generally susceptible of being more or less completely closed by an operculum attached to the foot of the animal behind. Four remarkable genera.

GENUS I. CONUS, Lin. *Cone.*

Shell conical, with the apex in front; the spire flat, or slightly projecting; aperture rectilinear, very close, elongated,

and narrowed by an enlargement of the straight edge and the folds of the columella.

GENUS II. CYPRÆA, Lin. *Porcelain.*

Spire projecting but little; aperture narrow and extending from one extremity to the other; shell resembling the half of an egg; the rounded part smooth and adorned with beautiful colours; the under side flattened.

GENUS III. PURPURA, Brug. *Purple.*

Shell oval and thick; columella without folds; provided with a short canal bent to the left; last whorl of the spire very large; aperture very wide.

GENUS IV. CASSIS, Brug. *Helmet.*

Shell flattened behind, or with a spire only slightly projecting; aperture narrow, long and terminated anteriorly by a very short canal, emarginated and reflected to the rear; columella indented and plicated.

ACEPHALA.

Mollusca without distinct head, whose mouth, having no teeth, is concealed under the mantle, and cannot be thrust forward, so that the animal rather receives the nutritive molecules brought by the water than seizes them of its own accord; only the senses of touch and taste are certainly ascertained to exist. This class includes almost all the bivalved shells, a great number of the multivalves, and some without shells. The mantle opens in various ways, sometimes before, sometimes all round, and then again only upon one side; the shell is closed by means of muscles specially destined for that purpose; it opens by the action of an elastic ligament

placed behind the hinge, and which throws open the valves when the muscles relax.

FAMILY I. OSTRACEA.

The mantle open, without tubes or any particular apertures; foot very small or entirely wanting; the greater part are fixed either by their shells or by their threads to rocks or other bodies under water. Two remarkable genera.

GENUS I. OSTREA. *Oyster.*

No foot; mantle provided with a double range of fringes; shell hinged, inequivalved and laminated; hinge without teeth; ligament small; a single muscular mass extending from one valve to the other.

GENUS II. AVICULA, Brug.

Besides the single transverse muscular mass, another fasciculus extending from one valve to the other, and placed before the mouth. Certain species are called Pintadinæ, the most celebrated of which yields the mother of pearl.

FAMILY II. MYTILACEA.

Mantle opening before, with another separate opening; all have a foot used in crawling, or at least in drawing out, directing and placing the byssus. Three remarkable genera.

GENUS I. MYTILUS, Lin. *Sea Muscle.*

Shell swollen out into a triangle with equal valves; one is fixed by a byssus. [The rocks of the sea.]

GENUS II. ANODONTEA.

No byssus; hinge without a tooth; in the interior of the shell a silvery nacre, and sometimes the most brilliant colours, purple and pink. [Fresh waters.]

GENUS III. UNIO.

Shell has a short cavity in one valve near the hinge, which receives a short plate or tooth of the other, and behind it is a long plate, which is inserted between two other plates on the opposite side. [Fresh waters; species of the United States numerous.]

FAMILY III. INCLUSA.

Mantle opening at the anterior end, or towards the middle, only for the passage of the foot, and prolonged at the other end into a double tube, which issues from the shell.

GENUS TEREDO.

Mantle prolonged into a tunnel much longer than the two little rhomboidal valves, and terminated by two short tubes, the base of which is furnished on each side with a stony and movable palette. The Teredo penetrates while young into the wood which it finds submerged, where, by the aid of its valves, it digs out for itself a residence, enlarging it as it grows in size.

*Third Great Division of the Animal Kingdom.***ANIMALIA ARTICULATA.**

THIS division is well characterized by an external articulated skeleton in the form of a sheath, adapted, according to the different genera, for walking, running, swimming, or for flight. This skeleton is either composed of hard articulated rings or is membranous or soft. The mode of connection of the articulations of the limbs is by two points, allowing only a hinge-like motion; but in the body the connection is by flexible membranes or by parts fitting into each other.

The Articulata resemble each other most in their nervous system. The brain is situated upon the oesophagus, and supplies the parts near the head with nerves. A double row of ganglia extend along the abdomen, and are united together and with the brain by nervous cords. Each of these supply the place of additional brains, and send nerves to the neighbouring parts.

The kind of respiration, the organs of circulation, and even the colour of the blood, exhibit so much difference, as to require separate notice in each class.

The classes are four. The Annulata or red blooded worms; the Crustacea; the Arachnides, and the Insecta.

ANNULATA.

Body divided into numerous rings; the head hardly distinct from the other segments, and without antennæ properly so called; nervous system composed of a long series of ganglions, one pair to each ring; eyes scarcely distinguishable, or entirely wanting; never organs of hearing or smell; skin soft, never stony or like bark; no articulated feet; stiff hairs, in the greater number, for locomotion; respiration either by exterior organs analogous to branchiæ, or by interior organs having no resemblance to tracheæ, or even by the surface of the skin; red blood inclosed in two systems of vessels, where it moves under the influence of contractile pouches, called hearts by some authors; mouth presenting either a vent hole or a long protractile trunk, or small horny jaws; nearly all live in the water (earth worms or *lumbrici* excepted); all appear to be more or less carnivorous. Three orders.

ORDER I. TUBICOLÆ.

Branchiæ in the form of tufts or arbusculæ, attached to the head or anterior part of the body; ordinary habitation in horny or calcareous tubes formed by a transudation of the skin of the animal, or by fragments of shells and particles of mud agglutinated upon a membrane secreted by the animal. All the species live in the sea.

GENUS AMPHITRITE, Cuv.

The Amphitrite are known by the gold coloured setæ, arranged like a crown or the teeth of a comb on the fore part of their head; their mouth is surrounded by numerous tentacula.

ORDER II. DORSIBRANCHIATA.

Branchiæ in the form of tufts, arbusculæ, laminæ or tubercles placed upon the middle of the body, or along the sides ; most species live in the mud, or swim freely in the sea ; a few have tubes.

GENUS APHRODITA, Lin.

Back covered by two longitudinal ranges of scales, under which are concealed the branchiæ ; body usually flat, short and broad.

ORDER III. ABRANCHIATÆ.

No apparent branchiæ ; respiration by the surface of the skin, or, as it is thought, in some by internal cavities ; the greater part live free in the water or mud, some in the moist earth. Two families ; one of which have setæ, the other is without any.

FAMILY I. ABRANCHIATÆ SETIGERÆ.

One remarkable genus.

LUMBRICI, Lin. *Earth-Worms.*

Body long, cylindrical and formed by a great number of rings ; no eyes, tentacula or branchiæ ; mouth without teeth ; the common Worm is so widely disseminated as to be universally known ; its body, which sometimes attains the length of a foot, includes more than one hundred and twenty rings, each having eight hairs beneath ; it feeds on vegetable matter or animal substances.

Circulation of the Earth-Worm, Pl. 31, Fig. 1 : A, dorsal vessel ; B, abdominal vessel ; C, subnervous vessel ; D, moniliform vessels or hearts ; E, deep seated abdomino-dorsal vessels ; F, superficial abdomino-dorsal vessels.

The mixed blood of the dorsal vessel A is conveyed, by the contractions of the hearts D, into the abdominal vessel B, which distributes it to the different parts of the body ; thence

it returns, as venous blood, through the vessels E, into the dorsal vessel, which transmits it into the vessel C, where, after having regained its nutritive properties, it returns, by the vessels F, into the dorsal vessel, and there mixes with the venous blood brought by the vessels E.

FAMILY II. ABRANCHIATÆ ASETIGERÆ.

One remarkable genus.

HIRUDO, Lin. *Leech.*

Body elongated, flat beneath, convex above, soft, retractile, and composed of a great number of segments; small apertures are to be observed in the inferior surface and upon the sides, corresponding to small vesicles, considered by some authors as organs of respiration; mouth sometimes composed (as in the medicinal species) of a vent-hole, encircled by a lip, at the bottom of which are three jaws, each armed upon the edge with two rows of very fine teeth; sometimes the teeth are few and blunt; sometimes the mouth is entirely without horny points; crawling is effected by means of the disk at the mouth, and another placed at the posterior part of the body.

Pulmonary circulation of the Leech, Pl. 31, Fig. 2: A, a lateral vessel; B, pulmonary auricle; C, latero-dorsal vessel; D, a latero-abdominal vessel; E, pulmonary vessel; F, pulmonary pouch.

In the Leech there are four longitudinal trunks, one of which is the dorsal vessel, another the subnervous, and the other two are abdominal vessels. These vessels all communicate with each other both by capillaries and by large branches (C, D). From these branches are given off the vessels destined for general nutrition and cutaneous respiration; but there is likewise a pulmonary respiration carried on by means of a double apparatus, consisting of particular vessels and a pulmonary pouch (F). The blood passes from the vessel D through E into the capillaries on the surface of the pouch F; it returns from thence through the pulmonary auricle B into the lateral vessel A.

CRUSTACEA.

Body divided into rings more or less distinct, movable, of considerable consistency (horny or calcareous), and having a double series of articulated membranes constituting one or more, frequently two pairs of antennæ; several jaws or other organs serving for prehension of food; several pairs of nata-tory or ambulatory feet (in general five or seven pairs); nervous system composed either of a great number of similar nervous swellings, disposed by pairs, and united so as to form two ganglionic chains, distant from each other, and ex-tending throughout the length of the body, or of two ganglions dissimilar in form, volume and disposition, but always simple and single, and situated one on the head, the other on the thorax. Circulation complete; heart aortic; respiration by branchiæ; eyes compound, in a few cases simple, and de-scending, by successive modifications of organization, to pe-diculated eyes with *facets*, composed each of an hexagonal or square corneal, a conical crystalline, or vitreous body, and a gelatinous substance, surrounded, as well as the crystalline, with a colouring matter, and considered as an expansion of the optic nerve. Almost always there is an auditory appa-ratus which consists in a small tubercle situated between the mouth and the base of the external antennæ, including a vessel filled with an aqueous liquid. Three remarkable orders.

ORDER DECAPODA.

Rings of the head and thorax soldered together and con-cealed under an enormous carapax which extends to the ab-

domen; branchiae formed of lamellæ or filaments, always simple and inserted in the internal paries of a special cavity situated on each side of the thorax, and formed by the lateral prolongation of the carapax; heart nearly quadrilateral, situated in the middle of the thorax; from this heart spring six principal arteries, distributing the blood through all parts of the body; buccal apparatus extremely complicated, and composed of a lip, small tongue, and six pairs of members, viz. a pair of mandibles, two pairs of jaws, and three pairs of foot jaws; five pairs of true feet, formed of six articulations; 1, the *coxa* or hip; 2, the *femur* or thigh; 3, the *tibia* or leg; and the true foot, consisting of, 4, the *carpus*; 5, the *pollex*; 6, the *index*. Four antennæ inserted between the eyes and mouth; eyes with facets, pedunculated and movable. Two families.

Explanation of Fig. A, Pl. 33. Respiratory apparatus of a Decapoda: 1, branchiae; 2, venous sinus; 3, vessel carrying out blood; 4, vessels returning blood; 5, heart; 6, sternal artery. The small arrows show the course of the blood through the vessels.

FAMILY OF THE BRACHYURA.

Tail but little developed, hardly of any use in locomotion, without false natatory feet, never terminated by a fin, in the form of a fan, and doubled up under the body. Three remarkable genera.

GENUS PORTUNUS, Fabr.

The two posterior feet terminating in fins; shell forming the segment of a circle, wider than long; dilated before, narrowed behind; short ocular pedicles; tail of the males with five distinct rings, seven in the females.

GENUS CANCER, Fabr. *Crab proper.*

Posterior feet ambulatory; carapax at least once and a half as wide as long, of a tolerably regular oval, and very convex above; anterior feet thick and short.

GENUS GECARCINUS. *Leech.*

Shell in the form of a heart, thick, without teeth or spines; pedicles of the eyes short and lodged in rounded cavities;

foot-jaws wide apart, leaving exposed a portion of the interior of the mouth.

FAMILY OF THE MACROURA.

Tail well developed, generally longer than the cephalothoracic portion of the body, extending behind and employed in natation; it has always beneath it lamellous false feet, and at its extremity a fin in the form of a fan. Four remarkable genera.

GENUS PAGURUS, Fabr. *Hermit Crabs.*

Body elongated; tail extended, at least as long as the trunk; the four last feet much shorter than the preceding; posterior part of the body entirely soft. Inhabit marine shells.

GENUS PALEMON, Fabr. *Prawns.*

Body of a less solid consistence than that of the other Crustacea, arcuated, and, as it were, hunch-backed; the forehead prolonged into a beak-like point; lateral antennæ very long; the intermediate with three filaments; carpus inarticulated; second feet the longest.

GENUS ASTACUS, Fabr. *Lobster.*

The three first pairs of feet terminated by a dydactile hand, the first enormous and like a forceps; tail fan-like with lateral plates divided transversely.

GENUS PALINURUS, Fab.

Lateral antennæ hairy, exceedingly long and thick; feet simple; only four pair of false feet.

ORDER AMPHIPODA.

Eyes sessile and immovable; no carapax; body composed of rings; four first foot-jaws serving for locomotion; no proper branchiæ; mandibles provided with a palpus; the five first pairs of abdominal limbs aiding locomotion and not branchial; palpi of the thoracic limbs vesicular and branchial. Two remarkable genera.

GENUS PHRONIMA, Lat.

Four anterior pair of feet in the form of a hook; fifth didactyle; antennæ two; appendages of the tail six, styliform and forked.

GENUS TALIPRUS, Lat.

No foot in form of a hook; the haunch of the last pair of feet very large.

ORDER ISOPODA.

Characteristics of the preceding order; no palpi, however, to the mandibles; seldom any proper branchiæ; the first five pairs of false abdominal feet branchial.

GENUS ONISCUS, Lin. *Wood-Louse.*

Four antennæ (of which only the lateral ones are very apparent) with eight articulations, and covered at base by the lateral edges of the head; they inhabit dark and moist places.

ARACHNIDES.

Skin like bark, but neither horny nor calcareous; head confounded with the thorax; abdomen distinct; never wings; antennæ replaced by articulated pieces (chelicerae) terminated by one or two movable hooks; from two to twelve eyes grouped in various ways; never composite eyes; generally four pair of feet inserted in the thorax, and terminated by two, sometimes three hooks; nervous system composed of two cords which, except in the case of Scorpions, have but three ganglia; respiration by pulmonary sacs placed under the abdomen, or by ramified tracheæ, communicating with the

external air by fissures or apertures called *stigmata* or *spiracula*; there are from two to eight of them. Blood white; circulation in accordance with the mode of respiration. The most of them feed on Insects; either seizing them in the silky web which it fabricates, or catching them by running, or leaping upon them when they approach too near their retreat. Others live as Parasites, upon Vertebrated Animals; a certain species are found only in flour, upon cheese, and different vegetables.

ORDER I. PULMONARIA.

Respiration by pulmonary sacs placed under the abdomen, and communicating with the exterior air by *spiracula*; sometimes there are eight, four on each side, sometimes four, or two; from six to eight smooth eyes; heart consisting of a large cylindrical vessel, sending the blood through the arteries to the different parts of the body, and receiving by the veins that which has traversed the respiratory organs. Always four pairs of feet. Two remarkable families.

Explanation of Fig. B, Pl. 33. Circulation of Pulmonaria: 1, the heart; 2, artery carrying blood to the head; 3, respiratory apparatus; 4, vessels which reconvey the blood from the pulmonary sacs to the heart.

FAMILY I. ARANEIDES.

Foot-palpi without forceps at the end, and terminated at most by one small hook; four, or two, pulmonary pouches; last articulation of the chelicerae pierced near its extremity, for the issue of a poison, proceeding from a gland placed in the preceding joint. Abdomen soft, and furnished, in all, with four or six nipples, fleshy at the end, cylindrical or conical, articulated, situated very close to each other, and pierced at the extremity with an infinity of little holes, for the passage of a silky thread, issuing from reservoirs within. Legs composed of seven articulations, of which the two first form the hip, the next the thigh, the fourth and the fifth the tibia, and the two others the tarsus terminated by two or

three hooks, of which two only are dentelated like a comb. Eyes smooth and glistening in the dark. Two genera.

GENUS MYGALE, Walck.

Eight eyes situated at the extremity of the thorax and generally very close together; four pulmonary pouches; hairs on the tarsi concealing the hooks. These are often called Crab-Spiders; their bites are considered dangerous; the Mygale Avicularia will destroy a Humming Bird. The Mygale Cæmentaria, or mason, is remarkable for its industry; it digs subterranean galleries, one or two feet deep, in declivities, or places secure from inundation; these galleries it lines with fine silk, closing up the entrance by means of a solid trap, which fits with a hinge to the opening; this trap shuts of its own accord and closes the dwelling of the ingenious animal.

GENUS ARANEA, Lin.

Never more than two pulmonary pouches; contains two tribes.

Tribe of Sedentary Aranæ.

These weave webs; or at least cast abroad threads to surprise their prey, and always remain in these traps or their vicinity, as well as near their eggs.

SUBGENUS CLOTHO, Walck.

Eyes arranged in a triangle. These Spiders attach to stones a kind of tent, the exterior of which resembles the finest taffety; it is composed, according to the age of the animal, of a greater or less number of layers; the top of the stone within is furnished with a kind of carpet of extreme whiteness and softness. An imperceptible window, produced by the separation of two portions of the exterior envelope crossing each other, serves as a gate to the dwelling.

SUBGENUS ARANEA PROPER.

Eyes arranged in a slightly curved line. These construct in the interior of our houses, in angles of walls, upon plants, hedges, and often upon road sides, either in the earth or under stones, an angular web, to the upper part of which is a tube

in which they remain motionless. They are remarkable for the care which they take of their eggs, and the industry which they exhibit in the construction of their nests.

Tribe of vagabond Spiders.

Two, or four of their eyes often much larger than the rest; thorax large; feet robust; they construct no webs, but watch for their prey and seize it by hunting it down or leaping upon it. One remarkable subgenus.

SUBGENUS LYCOSA.

Holes excavated in the earth, and the walls of which are fortified by threads which prevent their caving in, are the dwellings of these animals; here they pass the winter, sometime closing the entrance. At the door of this residence they lie in wait for prey. The female carries about with her every where the cocoon containing her eggs, having attached them to her abdomen with silk. The young progeny thus enclosed, live in this way some time, grouped about the abdomen of the mother, and giving her a hideous appearance. The bite of the *Lycosa Tarentula* was formerly considered very dangerous—incurable it was supposed—except with the aid of music.

FAMILY II. PEDIPALPI.

Palpi very large, in the form of projecting arms terminated by a forceps or claw. Chelicerae of two fingers, one of which is movable. Abdomen composed of segments very distinct, and without *fusi*; the whole body clothed in a tolerably solid *dermis*; two, or four pairs of pulmonary sacs. One remarkable genus.

GENUS SCORPIO.

Abdomen intimately united with the thorax; tail of six joints, knotty, slim, and terminated by a sting. Nervous system presenting seven ganglions. They live upon the ground or under heaps of stones; many species in houses. The number of Scorpions met with in certain countries is sometimes so considerable that, as some travellers relate, the inhabitants have been forced to abandon them. In spite of

all that has been said respecting the dangerous sting of these animals, the consequence is not usually very serious, and accidents, when occurring, have been occasioned by ignorant and absurd treatment. Ælian relates that the priests of Isis at Coptos in Egypt trampled with impunity upon the very numerous Scorpions of that town; and it is certain that the introduction of poison from the sting of the European animal is attended with but trifling results. Certain naturalists pretend that the Black Scorpion, living among the rocks of Africa, will cause the death of a man, with its sting, in less than two hours. It is not true that the animal turns its sting upon itself when placed within a circle of fire.

ORDER II. TRACHEARIE.

Respiratory organs consisting in radiated, or ramified tracheæ, receiving air by two apertures or stigmata only; no veins, or arteries. From two to four eyes. One remarkable family.

FAMILY HOLETRA.

Thorax and abdomen united in one mass under a common epidermis; generally eight feet, sometimes only six. Two remarkable genera.

GENUS ACARUS. *Mite.*

Sometimes cheliceræ, but simply formed of a single forceps, either didactyle or monodactyle; sometimes a sucker composed of laminæ in the form of a lancet, and united. Sometimes in place of a mouth is a mere cavity, without other apparent apparatus. The most of these animals are very small, even microscopic; some are vagabond, and to be met with upon stones, leaves, the bark of trees, in earth, water, flour, putrefied meat and old cheese; others live parasitically upon the skin, or in the flesh, of diverse animals; they have even been observed in the brain and eyes of animals.

GENUS *IXODES*, Lat. *Tick.*

Legs eight, no chelicerae, palpi projecting, serving as a sheath to the sucker, sucker hard and dentated, body covered with a hard skin; Parasitical animals, they are found in thick woods, and fasten themselves upon Oxen, Horses, Dogs, &c., so strongly that they can only be detached by force.

INSECTA.

We now enter upon that department of Natural History which treats of Insects; by the study of which we are conducted into a province the most extensive, and by far the most populous of the whole empire of nature. The residence of quadrupeds, as we have seen, is confined to the land; that of fishes to the water; while birds are enabled to rise from the surface of these elements into the aerial regions. Nature, however, has assigned a still more extensive range to those animals upon whose history we are now entering. They are found to pervade every part of her dominions, in numbers that defy all computation; for in nothing does the immensity of her works more strikingly appear than in the infinite number and variety of these smaller productions.

But although a complete history of the operations of nature in this large and populous part of her empire cannot be expected, yet such a general picture may be given as shall demonstrate the existence of that great vivifying principle by which she is animated, and by which she is enabled continually to pour forth into existence such immense numbers of organized beings. A lucid classification of such Insects as most frequently occur, and whose manners are best known, presents to us a pleasing view of that protection which Pro-

vidence affords even to the smallest of its creatures ; of the means it employs for perpetuating them, and of that great arrangement of nature by which one set of living beings find subsistence by devouring another, and by which life is continued through every part of the creation without a pause.

Insects have a dorsal vessel analogous to a heart, but no vessels for circulation ; respiration is performed by means of tracheæ extending parallel to each other throughout the body, communicating at intervals with stigmata or external openings, which admit air. The nervous system of most Insects consists of two principal and twelve inferior ganglions, each of which distribute nerves to the neighbouring parts. The digestive apparatus is various according to their aliment.

The head bears the antennæ, eyes and mouth ; the eyes are either simple or compound ; the latter have a cornea with many small facets, and more or less convex, but in the former it is smooth ; the eyes are generally three in number, seated on the top of the head in a triangular form ; the mouth consists of six parts, the two upper of which are called *mandibles*, the rest *maxillæ* or *jaws* ; these latter are furnished with articulated filaments called *palpi*.

The trunk of insects is called *thorax* or *corselet* ; it is composed of three segments, affording points of attachment for the legs and wings. These are denominated the *prothorax*, the *mesothorax* and the *metathorax*. Sometimes, as in the Coleoptera, the anterior, much the largest and separated from the succeeding by an articulation, appears to form the whole trunk, and is called *thorax* or *corselet*.

The wings are membranous, dry and elastic organs, commonly translucent and attached to the sides of the back of the thorax ; when they are four the first pair is joined to the second, and the other to the third segment of the thorax, when only two to the second segment. They are formed of two membranes, traversed by numerous nervures, which are tracheal tubes. The wings are either two or four in number ; when only two, an opaque species of scale (*elytra*), more or less solid, and which opens and shuts, takes the place of the anterior wings in many Insects, and beneath this the wings are folded when at rest.

The organs of locomotion consist of a *coxa* of two pieces, a *femur*, an unarticulated *tibia* and a *tarsus*. The number of phalanges vary from three to five, and the last joint is usually terminated by two hooks.

The abdomen presents nine or ten segments, some of which are however frequently reduced.

Explanation of Fig. A, Pl. 34. Aptera: 1, the head; 2, the maxillary palpi; 3, three segments of the thorax; 4, anterior wing of the mesothorax; 5, posterior wing of the mesothorax; 6, the thigh (femur); 7, tibia; 8, tarsus.

Fig. A, Pl. 35 Coleoptera: 1, the head; 2, the prothorax; 3, the corselet; 4, the mesothorax; 5, the metathorax; 6, the elytra; 7, the wings; 8, the two first rings of the abdomen.

There are some Insects which pass through their stages of life under three different forms; viz., that of *larvæ*, of *pupæ*, and of *perfect Insects*; these changes are termed the *metamorphosis*. The Butterfly is an example: the eggs of the Butterfly are hatched and produce animals, called *Caterpillars*, with an elongated body, divided into rings, having a head with jaws and several small eyes; feet six, scaly and anterior, the rest membranous and posterior. In this state these animals live for some time, frequently changing their skin; finally from the skin of the Caterpillar issues a totally different being, of an oblong form and without distinct limbs, it soon ceases to move, and remains a long time apparently dead, and is called a *Chrysalis*. In time the skin of the Chrysalis splits, and therefrom issues the Butterfly, moist and with short flabby wings; it soon however dries, the wings enlarge, and the animal is perfect and ready for flight.

All Insects do not pass through these stages. Those without wings do not change, and are said to be *without metamorphosis*. Of those which have wings many only experience the change of receiving them; these are said to undergo a *semi-metamorphosis*. The remainder are said to experience a *complete metamorphosis*.

ORDER I. APTERA.

Insects without wings and without metamorphosis ; that is to say, maintaining always the form in which they issue from the egg.

FAMILY I. MYRIAPODA. CENTIPEDES.

Body very much elongated and composed of a series of similar annuli, each of which sustains one or two pairs of feet ; the number of the rings and feet augmenting with the age of the animal ; abdomen not distinct from the thorax ; head provided with two eyes formed by an union of smooth ocelli (little eggs) ; two antennæ ; a mouth armed with jaws. They live in the earth, and under different bodies placed upon its surface.

FAMILY II. PARASITA.

Six feet only ; abdomen without articulated and movable appendages ; two, or four, small smooth eyes ; a great portion of the mouth internal, and exhibiting externally either a snout or projecting mammilla, containing a retractile sucker, or two membranous and approximated lips, with two hooked mandibles. Body flattened, transparent, divided into eleven or twelve segments, of which three belong to the trunk, and have each a pair of feet. They dwell constantly upon the same Quadrupeds and Birds, whose blood they suck. So great is their fecundity, that it has been calculated their females, in two months, can give birth to eighteen thousand young. Certain people, called Phtirophages, such as the Hottentots and New Zealanders, eat these disgusting animals.

GENUS I. PEDICULUS, Deg. *True Louse.*

Mouth exhibiting externally a very small mammilla, containing a sucker. Tarsi composed of one articulation, almost equal in size to the tibia, and terminated by a very stout nail, folding over a projection, so as to form a kind of tooth, whose office is that of a forceps.

GENUS II. RICINUS, Deg.

Mouth composed externally of two lips and two mandibles, resembling hooks; tarsi articulated and terminated by two equal hooks. All, with the exception of the Dog species, live upon Birds.

FAMILY III. SUCTORIA.

Instead of a mouth a sucker of three pieces, included between two laminæ, forming, together, a trunk or beak, either cylindrical or conical. Only one genus.

PULEX, Lin. *Flea.*

Body oval, compressed, clothed with a sufficiently firm skin, and divided into twelve segments. Head small, with a little round eye on each side. Feet strong, particularly the hind ones, which are the longest, and enable these animals to leap more than two hundred times their own height. Fleas are not born under the form in which we recognize them; their eggs produce little larvæ, without feet, and like worms; they are exceedingly lively, rolling themselves into a circle, or spirally, and crawling with a serpentine motion; they are at first white, and then reddish. After remaining for twelve days in this shape, they enclose themselves in a little silky cocoon, where they become *nymphs*, and whence they issue in the perfect state at the expiration of twelve days again. A particular species, known in America by the name of *chigre*, introduces itself under the nails of the feet and hands, and beneath the skin of the heel, and there soon acquires the volume of a small pea, by the rapid growth of the eggs which it carries in a membranous sac beneath the abdomen.

ORDER II. COLEOPTERA.

Four wings, of which the superior, called *elytra*, are generally hard, thick and short, serving as cases for the inferior, which are membranous, and folded transversely; head provided with two antennæ, of various forms, and almost always

with eleven articulations; two eyes, with facets; no smooth eyes; mouth composed of a labrum, or upper lip, a pair of mandibles of a scaly consistence, a pair of jaws having each one or two pair of palpi, and a labium, having a pair of labial palpi. Larva vermiform, with six short feet; nymph inactive, with limbs visible; metamorphosis complete. They are the best known and most numerous of insects. Four sections.

Section I. Pentamera.

Five articulations in each tarsus. Four families.

FAMILY I. CARNIVORA.

Two pairs of maxillary palpi, and one of labial; antennæ filiform. Three remarkable genera.

GENUS I. CICINDELA, Lat.

Head strong; eyes large and projecting; corselet very narrow and round; mouth bristled with hairs; body generally of a deeper or lighter green, mingled with metallic and brilliant colours, and having white spots upon the cases. Habitation in sandy places, where they actively pursue Flies and other Insects. Their larvæ are found in the sand, where they excavate perpendicular holes, and place their large head at the opening, in order to lower it rapidly, like a trap, whenever an Insect happens to pass over the treacherous bridge.

GENUS II. CARABUS.

This genus is characterized by setaceous antennæ, and by the shape of the thorax, which resembles a heart; the point cut off and margined. The elytra are likewise surrounded with a margin.

In their winged state, the heads of these animals are prominent; their mouths are armed with jaws, and four palpi. Their eggs are deposited under ground, or in decayed trees, where the larvæ reside till they are metamorphosed. It is not vegetable production alone that they devour: they are the greatest tyrants to other Insects, and destroy, indiscriminately, as many as their strength enables them to overcome. They frequently emit a fetid odour, and discharge an acrid, caustic liquor, when touched.

GENUS III. GYRINUS.

These animals have four eyes, two on the upper, and two on the under side of the head ; the antennæ are clavated, stiff, and shorter than the head. The hinder legs are also short, flat, and very broad.

The colour of this insect is a resplendent black, with a shade of brown. The elytra are adorned with beautiful striæ, consisting of a number of points, so minute as hardly to be observed without the assistance of a microscope. On the hinder part of the margins of the elytra are seen, by the same means, small protuberances, borne upon pedicles, and so deciduous, that the smallest friction sweeps them away. The feet of this Insect are of a yellowish brown, and the hinder pair so short, that in certain positions the animal seems to have but two. These are the insects seen wheeling around with inconceivable rapidity on the surface of stagnant waters.

FAMILY II. SERRICORNES.

Antennæ filiform, or like a saw. Three remarkable genera.

GENUS I. ELATER.

The insects of this genus are distinguished by setaceous antennæ, but more particularly by an elastic spine, which springs from the under side of the thorax, near the extremity. By the means of this spring, these animals, when turned upon the back, are capable of jumping into the air, and recovering their position.

In the state of larvæ, the insects of this genus inhabit the trunks of decayed trees, and are there metamorphosed into the winged form. Their residence is then changed, and they are seen in various haunts, flowers, thickets or open fields.

The chestnut-coloured Elater. This Insect is found both in corn and pasture fields.

The antennæ are branchy, and the tips of the elytra black ; the rest of a pale flesh colour ; the thorax is covered with a fine ash-coloured down. A South American species gives out a vivid light during the night.

GENUS II. LAMPYRIS.

Elytra soft; corselet semicircular, and covering the head ;

female generally without wings. They are nocturnal Insects, lying concealed among the grass in the daytime, and only issuing at night; the female then emits a bluish phosphorescent glow.

GENUS III. ANOBIUM, Fab.

Body round; head covered by the corselet; these Insects gnaw the wood of old furniture, and in the nuptial season call each other by striking the head upon the surface of solid bodies, after fixing themselves there firmly with their claws; the noise thus produced has procured them the vulgar appellation of Death-watch.

FAMILY III. CLAVICORNES.

Antennæ in form of a club. One remarkable genus.

GENUS DERMESTES.

Body somewhat depressed; antennæ longer than the head; the larvæ attach themselves particularly to the skin of dead animals; the perfect Insect lives upon flowers.

FAMILY IV. LAMELLICORNES.

Antennæ terminated by a collection of lamellæ arranged like a fan, or the leaves of a book; the anterior part of the body generally projects in the form of a hood. Three remarkable genera.

GENUS I. SCARABÆUS.

Body thick and convex; hood exceedingly short; flight heavy, and in a right line. They inhabit the hot regions of both continents.

GENUS II. MELOLONTA, Fab.

Hood wide and square; elytra hard and long; antennæ with ten articulations, of which five or seven in the males, six or four in the females, compose the club; larvæ soft, elongated, and known by the name of White Worms.

GENUS III. LUCANUS.

Body flattened; head at least as large as the corselet in the males, who often exhibit well developed mandibles.

Section II. Heteromera.

Five joints to the four first tarsi; one less in the two last.
One remarkable genus.

GENUS CANTHARIS.

Elytra soft and flexible; head a little wider than the corselet, which is nearly ovoid, and reflexed anteriorly; antennæ filiform; tarsi with entire joints and cleft hooks; diverse species are employed externally as epispastics. They are seen in May and June, principally upon the ash and lilac.

Section III. Tetramera.

Four joints to each tarsus; they live on flowers or the leaves of plants. Two remarkable genera.

GENUS I. CALANDRA.

Antennæ clubbed and inserted upon a sort of trunk produced by the anterior prolongation of the head; larvæ without feet, and formidable for their devastations among grain, of which they devour the interior without touching the bark; a pair will produce from six to fifteen young in a month. The most common species are known in the larva state by the name of Weevil.

GENUS II. PRIONUS.

Body depressed; corselet spiny; antennæ very long, like bristles and placed between the eyes; all the species are generally remarkable for the elegance of their forms and the brilliancy of their colours; they live in woods upon the trunks of trees, in the interior of which they exist as larvæ, nymphs and perfect insects.

*Section IV. Trimera.***GENUS COCCINELLA.**

Little Insects with hemispherical bodies, adorned with beautiful colours; their larvæ live principally upon grubs; and on this account are useful in gardens.

ORDER III. ORTHOPTERA.

Body generally softer than in the Coleoptera; elytra soft, semi-membranous and furnished with nervures; wings folded longitudinally, and generally like a fan, and divided by membranous nervures running in the same direction; antennæ less variable in shape than among the Coleoptera, and usually composed of a greater number of joints; eyes composite, sometimes accompanied with two or three small smooth eyes; jaws covered with a kind of casque called *galea*; mandibles very strong and horny; four palpi; the maxillaries composed of five articulations, the labials of three; metamorphosis partial, being confined to the growth and development of the elytra and wings, which begin to show themselves in the nymph in a rudimentary state, or like stumps; habitation always terrestrial even in their two first states; regimen herbivorous or carnivorous, but most frequently herbivorous. Two families.

FAMILY I. CURSORIA.

Posterior as well as anterior legs only adapted for running; females without horny ovipositor; no singing organ. Two genera.

GENUS I. FORFICULA, Lin.

Three joints to the tarsi; wings fan-like, and folded transversely beneath very short crustaceous elytra; body linear, and terminated by two large, movable and shelly pieces, forming a forceps.

GENUS II. MANTIS, Lin.

Corselet exceedingly elongated and narrow; five joints to each tarsus; anterior legs larger than the others; they use them for conveying their prey to the mouth, by quickly flexing the tibia against the thigh. The name of *Mantis*, which in Greek signifies *prophet*, is derived from the supposition that they indicate or point out objects when extending the feet. The Turks pay them a certain reverence.

FAMILY II. SALTATORIA.

The pair of posterior legs remarkable for the size of the thighs; legs spiny and adapted to leaping; males are endowed with the faculty of making a stridulous noise, vulgarly called their song; sometimes they produce it by rubbing rapidly, one against the other, the interior surfaces of their elytra; sometimes they excite it by a similar alternate action of the posterior thighs upon the elytra and wings, the thighs acting like the bow of a violin. Three genera.

GENUS I. GRYLLUS, Geoff.

In the males a portion of the elytron, in the form of a mirror or drum-head, forms the musical instrument; elytra and wings horizontal; three joints to the tarsi. Two subgenera.

SUBGENUS GRYLLO-TALPA, Lat.

Tibia and tarsi of the two anterior legs wide, flat, indented in the form of a hand and fit for digging. The female digs for herself, in June or July, to the depth of six inches, a subterranean cavity, round and smooth in the interior, where she deposits from two to four hundred eggs. This nest, with the passage to it, resembles a bottle with the neck bent.

SUBGENUS GRYLLUS PROPER.

No broad anterior feet. The Field-Gryllus digs for himself a very deep hole in a dry soil, exposed to the sun, and here lies in wait for Insects.

GENUS II. LOCUSTA, Geoff.

Same musical instruments as the Gryllus; mandibles less indented, and galea broader; elytra and wings tectiform; tarsus composed of four joints; always a projecting ovipositor in the form of a sabre, in the females.

GENUS III. ACRYDIUM. Cricket.

Stridulation of the males produced by rubbing the thighs against the elytra or wings; no projecting ovipositor in the females; elytra and wings tectiform or inclined; tarsus composed of three joints; antennæ sometimes filiform and cylindrical, sometimes in the form of a sword, or terminating in a club, and always as long as the head and corselet. Certain

species, called Travellers, unite in troops so considerable that, upon rising, they resemble a dark cloud, and convert all places where they sojourn into deserts. Their death is a new scourge; for, in putrefying, their bodies often emit exhalations which produce epidemic diseases. In certain parts of Africa the Insects are collected for eating, and also preserved in brine for commerce.

ORDER IV. HEMIPTERA.

Two wings covered by two elytra, generally membranous at their free extremity; mouth formed by a kind of articulated tube, curved inferiorly, resembling a beak, and exhibiting a groove including four stiff, pointed hairs, which have been considered as the rudiments of mandibles and jaws, organs which have disappeared in these Insects; metamorphosis generally incomplete; many have smooth eyes, but never more than two. Two sections.

Section I. Heteroptera.

Beak springing from the front; elytron membranous at the extremity; elytra and wings always horizontal, or slightly inclined.

GENUS I. CIMEX, Lin.

Three joints to the tarsi; antennæ longer than the head, and inserted between the eyes.

SUBGENUS PENTATOMA.

Elytra crossed, and partially coriaceous; antennæ with five joints.

SUBGENUS CIMEX PROPER, Lat. *Bed-Bug.*

Body wide, entirely without wings, and exceedingly depressed; antennæ with four joints, terminating abruptly in the form of setæ.

GENUS II. NEPA, Lin. *Water-Scorpions.*

Antennæ inserted and concealed under the eyes; they are shorter than the head, or, at least, of the same length; ante-

rior legs susceptible of folding up so as to form a forceps; tarsi with one or two articulations; they are all aquatic and carnivorous, and sting severely.

Section II. Homoptera.

Beak springing from the lowest part of the head; females provided with an ovipositor, composed of three dentelated laminæ, which they employ in notching vegetables to deposit their eggs; elytra throughout of the same consistence, and always tectiform and semi-membranous. Three remarkable genera.

GENUS I. CICADA.

Tarsi with three articulations; antennæ of six joints; head wider than the corselet; three simple eyes; elytra not crossed, tectiform, transparent and veined; a musical instrument in the males, composed of two kinds of drums or scales, which, through the influence of little muscles, become alternately convex and concave.

GENUS II. APHIS.

Tarsi with two articulations terminated by two hooks; antennæ with six or seven joints; elytra and wings oval or triangular and tectiform; beak very distinct. Nearly all these animals live in societies upon trees and plants, whose juice they suck with their proboscis. Their punctures cause the leaves or young vegetable shoots to assume different forms, as may be seen upon the young shoots of the linden, the leaves of the gooseberry, the apple, and more especially the elm, the poplar and the pistachio, where they produce warts or excrescences, enclosing families of Aphides, and often an abundant saccharine liquid.

GENUS III. COCCUS, LIN.

One joint only to the tarsus, with a single hook at the end; females without wings, and provided with a beak; the males have two wings, which lie one over the other horizontally; antennæ filiform or setaceous, and most commonly with eleven joints. The Cochineal (*C. Cacti*) belongs to this genus.

ORDER V. NEUROPTERA.

Four similar, naked, membranous and reticulated wings; mouth exhibiting mandibles, jaws and two lips, suitable for mastication; abdomen without sting, and seldom provided with an ovipositor; antennæ generally setaceous, and composed of a great number of articulations; small eyes, two or three; metamorphosis complete or incomplete; larvæ always furnished with six hooked feet, which they use in their search for food; form generally elegant; colour sometimes very brilliant; regimen carnivorous in the larvæ and perfect insects. Two remarkable families.

FAMILY OF THE SUBULICORNES.

Antennæ of not more than seven joints, and but little longer than the head; mandibles and jaws entirely covered by the labrum and labium; habitation, during the two states of larva and nymph, in the water, where they feed upon living prey. Two genera.

GENUS I. LIBELLULA, Lin. *Dragon-Flies.*

Head thick and round, or triangular; two large lateral eyes; three simple eyes placed upon the vertex; two antennæ inserted in the forehead; corselet thick and round; abdomen much elongated, and terminated, in the males, by two lamellar appendages; form slender; colours agreeable and various; wings large and like lustrous gauze; wonderful agility in pursuing Flies or other Insects upon which they prey; the larvae and nymphs (which differ only in the rudimental wings possessed by the latter) live in marshes, where they swim by means of a kind of oars, or by a particular mechanism, which consists in expelling from the abdomen a certain quantity of water previously introduced into the intestines, where there are organs resembling branchiæ.

GENUS II. EPHEMERA, Lin.

Body soft, long, tapering, and terminated posteriorly by two or three long and articulated setæ; wings inclined to the rear; legs very slender; tibiæ short and confounded with

the tarsi; anterior legs much longer than the others; mouth very small; mandibles hardly distinguishable. They derive their name from the brevity of their existence in the perfect state, never surviving the day of their birth. There are some of them, even, who are metamorphosed, lay eggs, and expire the same evening. The larvæ are elongated and soft; they live many years, previous to the metamorphosis, in holes with two issues, which they excavate in the banks of running waters.

FAMILY OF THE PLANIPENNES.

Antennæ with many joints, considerably longer than the head; mandibles very distinct; wings four, and alike. Two remarkable genera.

GENUS I. MYRMELEON, Lin. *Lion-Ant.*

Wings equal and tectiform; abdomen long and cylindrical, with two projecting appendages in the males; antennæ short, with hooks, and enlarged towards the extremity; the larva generally moves backwards; it digs in the sand a cavity in the form of a funnel, at the bottom of which it places itself with its two horns wide apart, and wo to the Ant or other small Insect that passes by the edge of this hole! the sand caves in, and it falls into the ambuscade; the Lion-Ant sucks its blood by the aid of its horns, which are also suckers, and then throws its body to a great distance, so that it may not serve as a warning to other Insects for whom it is lying in wait. If the prey is vigorous and resists, at the moment when the walls of the funnel are caving, the Lion-Ant, with its head, throws down upon it a shower of sand. The larva is not transformed for two years.

GENUS II. TERMES, Lin.

Tarsi with four articulations; wings folding horizontally upon the body, very long, slightly transparent, coloured, and with very fine nervures; abdomen terminated by two little points; antennæ setaceous; the larvæ live in society, and construct enormous nests of from ten to fifteen feet high, and sometimes capable of holding a dozen men; individuals called neuters, distinguished by their enormous head and strong

jaws, are charged with the defence of the habitation. The females arrived at the perfect state are taken care of and supplied with food before and during the period of laying eggs, by the larvæ or labourers, who place them in a particular lodging, situated in the middle of the dwelling. Some females lay, it is said, 60 eggs per minute, which is 3600 an hour, or 86,400 a day.

ORDER VI. HYMENOPTERA.

Four naked membranous wings veined longitudinally, the superior of which are always longer than the inferior; mouth composed of jaws and a labium very narrow, (besides the labrum and mandibles) forming a demi-tube more suitable for suction than mastication; envelope of the body not crustaceous; tarsi with five joints; abdomen generally attached to the thorax by a very slender pedicle, terminated, in the females, either by an ovipositor in the form of a saw, or by a simple retractile sting which introduces an irritating fluid into the wounds it creates; always three smooth eyes beside the two composite. Metamorphosis complete. Most of the larvæ are without feet, remaining motionless in the spot where born, and where they find food, brought, under certain circumstances, by the adult individuals. Those provided with feet attend to their nutrition. These insects present three kinds of individuals, whose colour and form vary greatly—the males, the females and the neuters. Two sections.

Section I. Terebrantia.

An ovipositor in the females. Two remarkable genera.

GENUS I. ICHNEUMON, Lin.

Maxillary palpi projecting; antennæ setaceous; abdomen cylindrical; in the females a long ovipositor with three threads. These insects are the most deadly enemies of the larvæ of others. Their females, with their long ovipositor, pierce a hole in the body of the Caterpillar, and there place

the egg; the worm which issues devours the entrails of the victim.

GENUS II. CYNIPS, Lin.

Head small; corselet thick and high, which causes them to appear as if hunch-backed; inferior wings with a single vein. The punctures which the female makes in plants for the purpose of introducing her eggs, cause excrescences denominated *gall-nuts*. The *Fig-Cynips* is famous for the services it renders in the East by bringing about the fecundation of the tree whose name it bears. In fact, these are the Insects which transport the *pollen* of the male flowers into the interior of the females, which are surrounded with a kind of skin having only a very narrow aperture at top.

Section II. Aculeata.

No ovipositor; a concealed retractile sting composed of three pieces; larvæ always without feet and living upon food brought them by the females and neuters. Three remarkable genera.

GENUS I. FORMICA, Lin. Ant.

Lips and jaws not projecting; antennæ filiform and geniculate; abdomen united to the thorax by a pedicle in the form of a scale or knot, single or double; each species is of three sorts—the males, the females whose wings are long, and the neuters which are apterous. They feed upon a great number of substances, but are particularly fond of saccharine matter; their habits are very curious.

GENUS II. VESPA, Lin. Wasp.

Superior wings folding longitudinally. Jaws not extending beyond the mandibles; antennæ with thirteen articulations in the males, and twelve in the females. The females and neuters build nests composed of a kind of paper or card which they make by bruising with their mandibles particles of decayed wood or bark, and reducing it to a paste by the aid of a fluid, which is supplied abundantly by their mouths. They feed upon insects, meat or fruit.

GENUS III. APIS, Lin. Bee.

Jaws probosci-form, and extending beyond the mandibles;

the first joint of the posterior tarsus very large and compressed in the form of a square or triangular face.

SUBGENUS *BOMBUS*, Lat.

Corselet much larger than the head; posterior legs spiny.

SUBGENUS *APIS PROPER.*

Head and corselet equal in width; posterior legs without spines; first articulation of the tarsus *squared*.

ORDER VII. LEPIDOPTERA.

Four membranous wings covered with little coloured scales; mouth forming a rolled proboscis, produced by an elongation of the jaws, upon the sides of which are found the rudiments of mandibles and downy palpi. Metamorphosis complete; larvæ called *caterpillars*—of which some feed upon leaves, others, less common, gnaw the ligneous part of trees, softening it with a saliva which they disgorge; some live at the expense of woollen stuffs and furs. The nymphs are almost always motionless, and generally spin a cocoon to effect the metamorphosis.

FAMILY I. DIURNA.

Wings vertical during repose; antennæ terminated, in general, by a small round club, at other times tapering at the end and reflexed into a hook; caterpillars almost always provided with sixteen feet; chrysalis hardly ever enclosed in a cocoon, but suspended in the air by the posterior extremity of the body.

GENUS *PAPILIO*. *Butterfly.*

SUBGENUS *PAPILIO PROPER.*

The six feet adapted to walking; inferior palpi very short, hardly reaching the hood.

SUBGENUS *PARNASSIUS*.

Six feet adapted to walking; inferior palpi elevated beyond the hood and with three joints.

SUBGENUS VANESSA.

The two anterior feet considerably shorter; no ambulatory ones. Antennæ terminated abruptly by a short button; caterpillars covered with spines.

SUBGENUS POLYOMMATUS.

Two anterior feet as in the preceding, no ambulatory ones. Small eye-like spots upon the wings.

FAMILY II. CREPUSCULARIA.

Wings, during repose, horizontal or inclined; the inferior one retained to the superior by a stiff hair; antennæ in the form of an elongated club, prismatic or fusiform; sometimes they are pectiniform; caterpillars always provided with sixteen feet.

GENUS SPHINX.

Antennæ prismatic and terminating in hairs; wings long and horizontal; abdomen pointed. The Death's-headed Sphinx has occasioned much terror in certain countries by the kind of cry which it utters, and the insignia of death upon its corselet.

FAMILY III. NOCTURNA.

Wings, during repose, horizontal or inclined; the superior nearly always bridled to the inferior; antennæ decreasing in thickness from the base to the summit, or setaceous.

TRIBE OF THE BOMBYCES. *Silk-Worms.*

Proboscis always short and rudimental; wings extended, horizontal, or inclined so as to form a triangle with the body.

TRIBE OF THE TINEÆ. *Moths.*

Wings rolled cylindrically; the larvæ live in a sheath or case.

ORDER VIII. DIPTERA.

Body with teguments of the consistence of tender bark ; a trunk forming a univalved sheath, open beneath, and containing a sucker, composed of two, four, or six stiff bristles ; six feet, two membranous wings, above them two movable bodies called *halteres*. Two palpi; antennæ formed usually of three joints; eyes large, commonly three simple ones; thorax occupied in a great measure by the mesothorax; abdomen with from four to seven distinct segments; tarsi with five joints. Two divisions. Metamorphosis complete.

DIVISION I. NEMOCERA.

Body usually slender and elongated; head small; legs long and slender; wings elongated, and often narrow; antennæ filiform or setaceous, and frequently at least as long as the head and thorax together, and with not less than six articulations. One remarkable genus.

GENUS CULEX, Lin. *Musquito.*

Proboscis long, slender, projecting, and terminated by two small lips; sucker with five bristles; antennæ filiform, hairy and downy; no simple eyes; wings laid one over the other; palpi shorter than the proboscis.

These insects, of which only the females suck blood, show themselves but little during the day, except in the woods. The female lays from two hundred to three hundred eggs, one by one, placing one upon the other, and forming of the whole a kind of raft, which floats upon the water. The respiration of the larvæ who live in this element, is effected by means of a spiraculum, placed at the end of a long tube; this tube serving for the introduction of air into the tracheæ, the larva is obliged to live in a reverted position, keeping the extremity of its body upon the surface of the water.

DIVISION II. BRACHOCERA.

Body generally wide, and not long; head hemispherical, and of the breadth of the thorax; proboscis sometimes long, slender and coriaceous, sometimes short, thick and fleshy; a

sucker with two, four, or six bristles; feet moderately long; wings usually wide; antennæ with three articulations. Three remarkable genera.

GENUS I. TABANUS, Lin. *Gad-Fly.*

Head wide; sucker composed of six pieces, in the form of lancets; proboscis projecting, with two lips. They resemble large Flies, and are well known by the torments which they inflict upon Horses and Oxen, whose skin they pierce for the purpose of sucking their blood.

GENUS II. OESTRUS. *Bott.*

Hardly any vestige of mouth; sucker composed of two setæ, appearance like that of a large hairy fly; antennæ very short; tarsi terminated by two hooks and two pellets.

These Insects are rarely found in their perfect state. Each species is generally a parasite of some species of mammiferous animal, and places its eggs upon whatever part of the body is most suitable for its larvæ.

GENUS III. MUSCA. *Fly.*

Proboscis apparent, membranous, bi-labiate, and susceptible of being entirely drawn within the buccal cavity; sucker of two pieces.

Fourth Great Division of the Animal Kingdom.

ANIMALIA RADIATA.

ORGANIZATION more simple than in the three preceding branches ; the parts arranged around an axis, and upon two or more rays, or upon two or more lines extending from pole to pole ; nervous system indistinct, generally not apparent ; circulatory organs very incomplete, and, in the greater part, not existing at all ; seldom a mouth ; sometimes an intestinal *cul-de-sac* ; in the greater number a simple cavity, even in the thickness of the body, opening, sometimes by several suckers ; often no distinguishable mouth. Five classes.

ECHINODERMATA.

Skin well organized, sustained frequently by a sort of skeleton armed with articulated and movable points or spines, with an internal cavity in which viscera are floating ; vascular system confined to different portions of the intestines, and to the organs of respiration, which are, in general, very distinct, as well as the viscera ; nervous system very incomplete, filiform, and, in many species, even altogether imperceptible. Two orders.

ORDER I. ECHINODERMATA PEDICELLATA.

Envelope pierced with a great number of little holes, across which pass membranous tentacula, terminated by a small disk, fulfilling the office of vent-hole; such are the Echini or *Sea-urchins* and *Sea-stars*.

ORDER II. ECHINODERMATA APODA.

Body clothed in a coriaceous skin, without armour or vesiculous feet.

ENTOZOA.*

Body, in general, elongated or depressed, articulated or not articulated, and without limbs; no branchiae nor tracheæ, nor any other organ of respiration; no traces of a true circulation; some vestiges of nerves, but sufficiently obscure, as many naturalists have even doubted their existence; almost all live within other animals; there are hardly any tissues or cavities in which some have not been discovered; they have even been observed in muscles and the cerebral substance. The manner of their introduction into the animal economy has never been satisfactorily ascertained. Two orders.

* Intestinal Worms.

ORDER I. NEMATOIDEA.

An intestinal canal floating in a distinct abdominal cavity; a mouth; external skin furnished with muscular fibres. The Ascaris belongs to this order.

ORDER II. PARENCHYMATA.

Body inclosing in its parenchyma viscera indefinitely terminated, and resembling most frequently vascular ramifications, sometimes none apparent. Example, the Tænia.

ACALEPHA.

Marine animals, in whose organization we still perceive vessels, although Cuvier regards them as productions of the intestines excavated in the parenchyma of the body; form circular and radiated; a single orifice; no distinct organs of respiration. Their name, derived from the Greek, signifies *nettle*, and has been given to them on account of the faculty possessed by certain species of imparting to the hand which touches it a sensation of pricking and burning. Two orders.

ORDER I. SIMPLICIA.

Natation effected by means of the contractions of the body; some emit a phosphorent light, making the sea, at night, resemble a starry sky; substance gelatinous; no fibres apparent. Example, the Medusa.

ORDER II. HYDROSTATICA.

One or more bladders filled with air, and destined to support the animal in the midst of the fluid; very numerous appendages, some of which act as suckers, others as tentacula; no apparent mouth.

POLYPI.

Body cylindrical or conical, often without other viscera than its cavity; often, likewise, with a visible stomach, to which intestines adhere, or rather vessels excavated in the substance of the body; a single orifice surrounded by tentacula, and making these animals resemble the Octopus; production of new individuals by buds and by eggs. Two remarkable orders.

ORDER I. CARNOSI.

Body fleshy, contractile and without any solid matter external or internal; inferior extremity in form of a disk, serving to keep them stationary, sometimes aiding them to creep, and even susceptible of being detached, so as to permit them to swim; mouth surrounded by tentacula, resembling, in their expansion, the petals of a flower. Such are the Actiniæ or *Sea Anemones*.

ORDER II. CORALLIFERI.

Animals united in great numbers to form composite animals, protected and sustained by solid matters called *polypiers*, internal or external; nutrition, sensibility and will in common. Such are the Sponges, Madrepores, Tubipores and Coral.

INFUSORIA.

Little microscopic beings swarming in still waters; the greater number gelatinous and without viscera: at their head we place the species with the most complex organization. Two orders.

ORDER I. ROTIFERA.

Body oval; a mouth; a stomach; an intestine; and a tail; anteriorly a singular organ, which, by its vibrations, gives the appearance of revolving wheels.

ORDER II. HOMOGENEA.

No viscera; often not even the appearance of a mouth.

BOTANY.

BOTANY.

ELEMENTARY ORGANS.

SIMPLE ORGANS. CELLS AND VESSELS.

CELLS, OR CELLULAR TISSUE.

An assemblage of cells joined together, composed each of a spherical dodecaedric fusiform sac, generally from one-three-hundredths to one-five-hundredths of an inch in diameter; membrane of the sac fine, delicate, imperforate, and most frequently marked with dots; colour green, owing to the interior globules. The cellular tissue, which is the general, and sometimes the sole element of plants, increases by the development of new cells, either in the intervals, or, in some cases, in the interior of the old ones.

VESSELS.

TRACHEÆ.

Each a tube formed by a spiral thread which may be unrolled in the form of a corkscrew, and included in a membrane, as if it had *been born* in a cell; form cylindrical; diameter from one-three-hundredths to one-three-thousandths of an inch; extremities conical. They are found in all the organs of vascular plants, the leaves of flowers, &c., principally around the pith of dicotyledonous trees.

ANNULAR, OR RADIATED VESSELS.

Cylindrical tubes, not ramified, marked with regular transversal rays, parallel with each other, not susceptible of being unrolled, sometimes very close together, and, owing to the presence of veritable solid rings, fixed at variable distances from one vessel to another, but at equal distances in the same vessel; diameter the same as in the tracheæ.

PUNCTUATED VESSELS.

Cylindrical vessels, spotted with opaque points or dots, disposed in series, sometimes parallel, sometimes slightly oblique, and marked with paler rays, like rings, or in spirals, distant from each other by the diameter of the tube, at least. Diameter generally greater than the tracheæ.

MONILIFORM VESSELS.

Tubes punctuated, ramified, and slightly curved at irregular intervals; they are frequent in roots, articulations, or at the origin of branches and leaves.

RETICULAR VESSELS.

Cylindrical tubes, whose surface is covered with transversal, oblong spots, giving it the appearance of a net. Kieser has observed them in the Balsam and Nasturtium, principally in the root; he regards them as a modification of tracheæ, in which the spires are unequally combined. Lindley has found them in the Papyrus and Lily; Parkinge in the tissue which forms the internal portion of the cells of the anthers.

COMPOSITE ORGANS. INTERNAL ARRANGEMENT.

FIBRES.

Collections of vessels, composed generally, and especially in the *wood*, of punctuated vessels and tracheæ, surrounded by elongated, fusiform cells; the most solid fibres known are those of the *Phormium Tenax*, vulgarly called *New Zealand Flax*, which will support a weight represented by sixteen and one-third, those of flax supporting a weight represented by eleven and one-third.

RESERVOIRS OF THE PROPER JUICES.

Regular cavities produced in the tissue of vegetables by juices of diverse natures, generally coloured and odorous, which distend the cells and break their walls. These cavities are also improperly called *vessels*.

AERIAL CAVITIES.

Empty spaces of the size of three or four cells, produced either by a too rapid enlargement, or by a natural disposition

of the plant. They are met with in the trunk or in the leaves, where they communicate with the external air by little openings called *Stomata*.

EXTERNAL ARRANGEMENT.

EPIDERMIS.

The external, general envelope of plants, composed, first, of a simple superficial pellicle, without appreciable texture, pierced with elongated apertures, corresponding to the middle of the stomata; secondly, of one of several beds of utricles, diversely formed, according to the species, intimately united, and filled with a liquid which is generally colourless.

STOMATA.

Little oval apertures, rarely visible to the naked eye, presenting themselves, when viewed through a microscope, with dark lip-like edges, and situated between the ordinary cells of the epidermis, principally upon the parenchyma of the leaves, and communicating, internally, with air cells. They have the property of closing, when moistened.

LENTICLES.

Small tubes or punctuations found upon the surface of the branches of monocotyledonous vegetables, and which they render more or less rough to the touch; their colour is generally paler than that of the wood; the young roots issue through them, when a branch is put into the moist earth.

HAIRS.

Appendages of the cellular tissue, formed of elongated cells, and designated according to their forms, their consistency, or their physiological functions, as *simple*, *divided*, *aculeiform*, *glanduliferous*, *excretory*, &c.

THE ROOT.

The inferior part of vegetables, by which they are fixed to the earth, and through which the liquids which nourish them penetrate. It is characterized by growing in a direction opposite to that of the trunk; by being elongated only through its extremities; by being without stomata; by never becoming

green in the air ; and by being irresistibly attracted towards the centre of the globe. The part of the root which is united with the trunk is called the *neck*; the undivided portion succeeding the neck is termed the *body*, and, finally, the ramifications are distinguished as *radicles*. It is thought that the extremity of the radicles presents certain little bladders (spongeoles) which produce the phenomenon of *endosmosis*, or that phenomenon in which noxious fluids are thrown off, while nutritive are absorbed.

THE STEM.

That part of the vegetable which grows in an inverse direction with the root, which seeks the air and the light, bears flowers and leaves, and transfers the ascending sap to these latter from the roots. All vascular vegetables possess this organ, but it is sometimes excessively short, as in the Hyacinth, where it is reduced to a subterranean platform. The spot where the *root* joins the *stem* is called the *neck*. We must not confound with the *stem* two supports of certain Flowers, both without leaves; the one called *scape*, issues from the midst of the radical leaves (example, *Hyacinth*), the other, called *radical peduncle*, issues from the axil of a leaf. The tissue of the stem has a marked influence upon the ascent of the sap. In fact, water will ascend in a branch which we plunge inverted into a full vessel; it also mounts with great celerity and force in a slip of Vine, cut at some distance from the earth and stripped of its leaves. Hales, a celebrated English physician, in an experiment of this nature, saw the liquid raise a column of mercury to the height of thirty-eight inches.

THE TRUNK.

The stem of dicotyledonous Trees, such as the *Beech*, the *Oak*, &c. It is characterized externally by being conical, that is to say, by tapering from the base to the summit, and by being divided, at its upper part, into boughs, branches, and ramuscules or twigs, bearing leaves and flowers. Examined internally, it exhibits the medullary canal, and, upon the circumference, the ligneous beds and the bark. Its diametrical increase is brought about by the annual formation of

a layer of *wood* and a layer of *bark*, organized under the influence of a liquid called the sap. Hence it happens that the oldest layers of wood are at the centre, and the more recent at the circumference, while, with the bark, the reverse is the case.

The development in height is effected by buds, which, like so many young plants, contribute, by their growth, to augment the diameter of the base, and the extent of the plant considered in its *ensemble*. This particular mode of growth has caused the trunk to be called the *ligneous exogenous* stem.

THE PITH.

A white substance, composed of hexagonal cells, abundant and moist in the shoots, and dry in the old branches; it is contained in a canal formed principally of tracheals, and called the Medullary Sheath, or Canal.

THE LIGNEOUS LAYERS.

Formed of ligneous fibres, compacted together, and disposed in concentric beds; the oldest, generally of a deeper colour, are called the Wood, or *heart*, the new, of a brighter hue, the *alburnum*.

THE BARK

Is formed of three membranes, placed one over the other. For the description of the *epidermis*, see what is elsewhere said concerning Elementary Tissues. The *herbaceous envelope* is a plate or layer of cellular tissue placed beneath the epidermis, the parietes of whose cells contain little green grains, called *globuline*; it likewise contains the proper juices. The *liber* is formed of a series of superimposed laminæ, composing a vascular net, the meshes of which are filled with cellular tissue; the old *liber* forms the proper cortical covering. The *medullary rays* are laminæ of cellular tissue passing in the direction of the thickness of the trunk, from the centre to the circumference, and, in a horizontal cut of the tree, resembling the horary lines on a dial: they serve to establish a communication between the pith and herbaceous envelope.

STIPE.

The ligneous stem of monocotyledonous plants, presenting the appearance of a column of the same diameter throughout, except occasionally towards the middle, which is a little inflated. The stipe is seldom ramified, and is crowned by a bunch of flowers and leaves, forming a kind of capital. Internally, the fibres, instead of composing cones fitting together, are scattered in the midst of a general pith. At the circumference no bark is seen. The oldest ligneous fibres, instead of being at the centre, are, on the contrary, pressed towards the outside, on account of the particular manner in which this stem develops itself. In fact, every year new fibres arise in the centre, which push those of the preceding year towards the circumference. The *debris* of leaves engendered by these new fibres form a kind of ring, which augments with the total length of the tree. This mode of growth has given to the *stipe* the name of the *ligneous endogenous* stem.

CULM.

Stem proper to grasses, rarely divided, hollow internally, and exhibiting, at intervals, nodes or compact rings, whence spring alternate sheath-like leaves.

PHIZOMA.

The subterranean and horizontal stem of perennial plants, concealed entirely or partially beneath the earth, and throwing out from their anterior extremity new shoots, as their posterior extremity decays.

STEM PROPER.

The common stem of plants, and which is not included in any of the preceding species.

ESSENTIAL ORGANS.

BUDS.

Organs inclosing in scales, or other ligamentary substances, rudiments of a stem, of leaves, or of flowers.

BUDS PROPERLY SO CALLED.

Organs of various form, nature and aspect, generally composed of imbricated scales, including the rudiments of stems, leaves, or organs of reproduction. They develope themselves always upon the branches, at the axils of the leaves or at the extremity of the twigs.

We distinguish three kinds of buds, according to the different shoots to which they are to give birth. 1st, *Leaf-buds*, or *wood-buds*, which only shoot forth branches charged with leaves; they are elongated and pointed. 2d, *Flower-buds*, which produce only flowers, and which are commonly designated as *buttons*; they are short and rounded. 3d, *Mixed buds*, which give birth to both flowers and leaves; their form is between those of the two preceding classes.

TURIOS.

The only difference between the turion and the bud properly so called is that the former springs always from a perennial root, or rhizoma, that is to say from under ground [*Asparagus*], while the latter develops itself invariably upon a part exposed to the air and light.

BULBS.

A kind of subterranean bud appertaining especially to perennial monocotyledonous plants; it is supported by a kind of solid platform intermediate between it and the true root; it is to this flattened tubercle that the fleshy scales or tunics (coats) which form the bulb externally are affixed by their basis; the interior includes the rudiments of a shaft and leaves.

We distinguish three species of *bulbs*: 1st, *Tunicated bulbs*, which are formed of scales of a single piece, fitting one upon the other. 2d, *Scaly bulbs*, the scales of which are smaller, free at their upper edge, and covering each other as tiles upon a roof.

3d, *Solid bulbs*, the coats of which are so compact and confounded, that they are indistinguishable, and seem formed of a solid and homogeneous substance; this last however is more properly called a *cormus*.

TUBERCLES.

This name is given to short and thickened portions of a subterranean stem which holds in reserve the *amidon* destined to nourish the shoot or shoots which spring from them, as we see in the Potato and the Orchis. When small they are termed *tubercles*.

BULBILS.

Small solid or scaly buds growing upon different parts of the plant, and capable of a separate vegetation.

LEAVES.

Appendages of stems, generally membranous, plane, and greenish, in which the vegetable juices (water charged with carbonic acid) being put in relation with the fluids of the atmosphere, undergo important modifications which render them nutritive. Under the influence of the solar light, the carbonic acid which issues either from the part absorbed with the water, by the *spongioli*, or from the part absorbed by the leaves, is decomposed; the oxygen is exhaled; the carbon forms matter eminently combustible, such as *lignite* or wood, *saccharine*, *gum* and *amidon*. This respiration of leaves is accompanied by a very abundant aqueous exhalation; about two-thirds of the water absorbed by the roots.

We must regard the leaves as formed by the expansion of a collection or bundle of vessels, which, in some measure, compose their skeleton or veins; the intervals left between the veins are filled by a substance analogous with the herbageous envelope, *parenchyma*, which is moulded around these veins as the soft parts of animals around the bony system. It is evident that the general form of the leaf depends upon the disposition of the principal veins, and that the modifications exhibited by the edge of the same leaf depend upon the disposition of the secondary veins, the tertiary, &c. Whenever the principal or secondary veins are sufficiently near

together for the veins which spring from them to unite themselves at least at their base, the leaf is called *simple* (Pl. 42, Fig. 2); whenever, on the contrary, this junction cannot be effected, and the veins surrounded by the parenchyma are separated by clefts, the leaf is said to be divided; where several secondary parts are attached to a common petiole, each remaining distinct and free, the leaf will be compound (Pl. 41, Fig. 4), and the parts will bear the name of *folioles*. The leaves are *sessile* when they attach themselves by their base to the stem or branches; they are *petiolate* when they attach themselves to a support called *petiole* or foot stalk; the angle which the leaf makes with the stem is called the *axil*; the wide portion of the leaf is termed the *limb*; it has two faces, the superior and inferior.

EXPLANATION OF THE FIGURES ON PLATES 42, 43.

- Fig. 1, 2: Parallel veined leaves.
- Fig. 2, 3: Penniverved or feather-veined leaves.
- Fig. 4: Same, compound.
- Fig. 5, 6: Palminerved or radiated leaves.
- Fig. 7: Same, compound.
- Fig. 8, 9: Pedatinerved leaves.
- Fig. 10: Same, compound.
- Fig. 11, 12: Peltinerved or peltate leaves.
- Fig. 13: Same, compound.

EXPLANATION OF THE FIGURES ON PLATE 45.

- Fig. A: 1, monopetalous corolla; 2, monosepalous calyx.
- Fig. B: Irregular polypetalous corolla.
- Fig. C: Regular polypetalous corolla.
- Fig. D: Mode in which the pollen is disposed in an anther.
- Fig. E: Granules of the pollen floating in the fovilla.
- Fig. F: Dehiscence of an anther.
- Fig. G: 1, filament; 2, anther.
- Fig. H: 1, stigma; 2, style; 3, germen.
- Fig. K: Hypogenous stamens.
- Fig. L: Perigenous stamens.

Fig. P : Germen cut to show the ovules.

Fig. R : Round pollen, the external membrane of which bursts, and the interval forms a species of tube which bursts in its turn and suffers the pollenic granules to escape.

Fig. T : Section of a stigma, to show how it is traversed by the grains of the pollen.

Fig. X : 1, stigma ; 2, conducting tissue ; 3, expansion of the conducting tissue to receive the ovule ; 4, epicarp ; 5, endocarp ; 6, nutritive vessels of the ovule ; 7, raphe ; 8, chalaza ; 9, primine ; 10, secundine ; 11, exostome and endostome ; 12, tercine ; 13, embryo.

ACCESSORY ORGANS.

STIPULES.

Appendages of the leaves situated on the base of the petiole and presenting the appearance of small leaves or scales. [Plate 43, Fig. M.]

TENDRILS.

Simple threads or branches which roll themselves spirally around foreign bodies to sustain the stems which are provided with them. [Same Fig.]

THORNS

Are abortive branches and differ from *prickles* in being a continuation of the ligneous fibre. [Plate 43, Fig. N.]

PRICKLES.

Appendages of the stem or branches, simply articulated with the ligneous fibres. [Plate 43, Fig. O.]

INFLORESCENCE.

We give this name to the general disposition or arrangement assumed by the flowers upon the stems or other organs

which support them. The flower may be borne upon a species of foot-stalk called *peduncle*; or even attached immediately by its base, it is then *sessile*. When the peduncle is ramified, each of the divisions bearing a flower takes the name of *pedicel*; the small leaves, entirely different from the others, which are often found about one or several united flowers, are called *bracts*; a symmetrical disposition of these organs around one or more flowers, so as to form a kind of accessory envelope, bears the appellation of *involucrum*. Many monocolyledons have large alternate sheath-like bracts, which envelop the flowers in their first development, and which expand, little by little, in the form of a horn; these are *spathes*. When there is only one flower upon a plant, the inflorescence is said to be *unifloral*; when there are two, it is termed *geminata*; when three, *ternate*; when several from the same node, *verticillata*. There are two classes of inflorescence.

CLASS I. CENTRIPETAL OR INDEFINITE.

Flowers springing from the axil of the leaves, and expanding from the circumference to the centre. The varieties may be referred to two types.

TYPE I. SPIKE.

Flowers sessile in the axil of several leaves or bracts, and not detaching themselves after the florescence. [Wheat, Rye, &c.]

CATKIN OR AMENT.

Spike composed of male or female flowers only, surrounded by scales like bracts, withering and falling after florescence. [Hazel, Willow.]

CONE.

Spike where the flowers are provided with very large bracts, or such as are susceptible of increase after florescence, and which often have the appearance of an unique whole. [Pine.]

SPADIX.

Spike with a fleshy axis peculiar to monocotyledons, and,

while young, enveloped in a large bracte called *spathe*.
[Simple spadix, *Arum*; ramified spadix, Date.]

RACEME.

Flowers borne upon peduncles more or less elongated, and diminishing in size from the base to the summit. [Wild Cherry.]

THYRSE.

A compound raceme in which the middle peduncles are the longest, and are subdivided; differs from a panicle in being very dense. [Lilac.]

PANICLE.

A raceme where the pedicels along the main peduncle are divided and scattered. [Oats.]

CORYMB.

Like the umbel in appearance; but the peduncles stand at different points on the main stem, but elevate the flowers to nearly the same height. [Yarrow.]

TYPE II. UMBEL.

Peduncles springing from the same point of the stem, like the braces of an umbrella bearing floret on their extremities. The *simple umbel* has the peduncles non-ramified. [Primrose.] The composite umbel has the peduncles divided into pedicels. [Wild Carrots.]

CAPITULE.

Umbel where the pedicels are excessively short; flowers in great number, and so close set that they may be taken at a distance for a single flower.

CLASS II. CENTRIFUGAL OR DEFINITE.

Stem terminated by a central flower, having at its base generally two bractes, producing from their axil two new branches with a terminal flower, and so on. They are called *centrifugal*, because the expansion of the flowers takes place from the one central flower to those of the circumference. All the inflorescences of this kind are comprised in the generic title *cyme*. [Euphorbium, Chickweed.] The cyme re-

sembles the umbel in the peduncles arising from the same point, but differs in their being variously and alternately subdivided.

GRAFT.

Grafting consists in producing artificially the union of two plants. A portion of one is taken, called the *graft*, and placed in immediate contact with the other, which is termed the *subject*. The first condition of success is, to obtain a prolonged contact between fresh and living organs of two plants. In dicotyledons it is the *aubier* and *liber*, especially the point of junction where the cambium is, which offer the best chances of success; since it is here that the tissue is forming, or has just been formed. The second condition is, that this contact be established between analogous vegetables: the greater the analogy the more readily will the graft take. The operation is not always possible between plants of the same family, and it is impossible between plants of different families. There are a great many methods of grafting, but we must content ourselves with indicating the principal.

GRAFT BY APPROXIMATION.

Two neighbouring trees being left unrooted, a branch of each is bent down, and the two limbs strongly tied together, spots being brought in contact where the aubier is naked. When the junction is effected one of the branches may be cut off below.

GRAFT BY LIGNEOUS SCIONS.

A branch is cut, like a sort of bud, so as to be fitted to the top of a branch of another tree. Care must be taken so to cut the graft and notch the subject, that they may be exactly adapted. The notches are made in various ways. The most simple is to cut the subject so as to make the insertion in a simple slit; this is termed *cleft-grafting*; when several scions or grafts are inserted upon a large truncated branch, it is called *crown-grafting*.

GRAFT BY BUDS.

A slip of bark, having one or two buds, is exactly fitted to the subject, in the place of a similar slip removed ; the whole is tied up to produce an immediate contact, and to prevent injury from the wind or sun. When the strip of bark contains only one bud it is called a *shield-graft*; when there are several, and the strip is circular, it is an *annular graft*. By these means three hundred and thirty-six varieties of apples may be engrafted upon an old Pear tree.

HERBACEOUS GRAFT.

This does not differ greatly from the others as to the manner of fitting the scions or getting the buds; but it is practised upon herbs or upon tender shoots of trees. In this way the Melon has been grafted upon the Cucumber, and the Tomato upon the Potato.

THE FLOWER.

This name is given to the union of the organs destined to accomplish the reproduction, by germs, of phanerogamous plants. The flower is composed of leaves in a particular stage of transformation, springing from the extremity of the stem or its branches, and arranged in regular verticels or whorls. These verticels are various in number; they have a great tendency to become united, and their form differs from that of the leaf in proportion to their distance from the outer edge of the flower. They are divided into four classes: the calyx, externally; then the corolla and the stamens, and, within them, the pistils which crown the germs or ovules which become seeds. The calyx and the pistils are generally composed of a single verticel; but the corolla and the stamens are sometimes composed of many fitting together. Each verticel is ordinarily composed of five pieces in the dicotyledons, and of three in the monocotyledons. The portion of the stem, or of the branches, which supports the verticels, is called the *torus* or *receptacle*.

THE CALYX.

The parts of the calyx called the *sepals* form a primary external envelope. The analogy of these pieces with the leaves is evident; like these latter, they are often plane, green, and furnished with stomata; they present, too, the same internal organization, and fulfil the same physiological function. They are often united, more or less completely. When the calyx has the sepals thus united, it is called *gamomosepalous* or *monosepalous*, and when they are free, *polysepalous*. The coherent portion of a monosepalous calyx is called the *tube*, and its border the *limb*.

COROLLA.

Formed by one or several verticels of pieces called *petals*, generally of a brilliant colour, and exhaling odours more or less grateful. The corolla is called *monopetalous*, or *gamopetalous*, or *polypetalous*, according to the union or freedom of the petals. The expansion of the petal is termed the *limb*; and may be either entire or divided, regular or irregular; when the point of attachment in the petal is narrow, it is termed an *unguis* (claw).

THE STAMENS.

One or more organs within the petals, and having with them great analogy of position and transformation; they are inserted upon the *torus*, close to the petals, often adhering to them, and are even transformed into these organs, as in double Roses, where we often observe such a change to take place. When there is but one verticel of stamens, they are equal in number with the petals and (except in a few cases) alternate with them. When there are several verticels, each is composed of the same number of pieces, and the total number of the stamens is a multiple of that of the petals. The stamens perform an important part in the business of reproduction. When these organs are attached beneath the *germen* [Pl. 45, Fig. L] they are denominated *hypogenous*; when upon the calyx [Fig. K], *perigenous*; and when upon the superior part of the german [Fig. G], *epigenous*. A flower without stamens is called a *female flower*.

THE FILAMENT.

A part which is sometimes deficient or exceedingly short, which is usually cylindrical, rarely flattened, and of a consistency and nature analogous with the petals; it is never green. It is a support of the anther, as the *petiole* is of the leaf, and the claw is of the petals.

THE ANTER.

This organ may be compared to the limb of the leaf, of which the filament would be the petiole; this limb, narrow and thick, includes generally two compartments, containing the *pollen*; the opening of these compartments is usually in the direction of their length [Pl. 45, Fig. F], but may be effected in various ways, as Fig. O.

THE POLLEN

Is composed of a multitude of little yellow or reddish grains, which generally escape, in the form of dust, from the interior of the compartments, and which, by their fall upon the stigma, and the rupture of their envelope, permit exceedingly small granules, swimming in the midst of a liquid called *fo-villa*, to introduce themselves within the ovary, there to form, in their development, the germ destined to reproduce the plant, and called on this account the *embryo*.

THE CARPELS OR PISTILS.

The last series of organs as we proceed to the centre of the flower; composed of leaves more or less folded on the interior side and which bear upon their edges the *ovules* destined to become seeds. Besides the name of *carpels*, we also give to these leaves that of *pistils*, which was formerly applied to the *ensemble* of the organ, of whatever nature it might be, and now, by preference, to the united carpels, when not very numerous. The carpels are then considered as compartments. A flower without carpels is termed a male flower.

THE GERMEN

Or germ is a name given to the tumefied inferior portion of the pistil; it is the limb of the leaf in its largest part. The ovules are ranged within upon the two edges, which

fold towards the centre of the flower, and are united, at least in all the isolated carpels. The filament which supports them is called the *funiculus*; the point of the junction of the funicle and ovule, the *hilum*. Before expansion, the ovules present the appearance of pulpy excrescences without envelope or aperture; a little while afterwards the culminating point is pierced, and we distinguish a small ovoid body (*nucleus*) enveloped at its base by two membranes, the exterior called *primine*, the interior *secondine*; the common point of union of these two membranes is at the base of the ovary and is called the *chalaza*; the primine and secondine do not entirely cover the nucleus, but leave at the apex a round aperture called the *foramen* sometimes; the *raphe* is a line or ridge passing from the ovule to the chalaza, being the upper portion of the funiculus attached to the face of the ovule; the aperture of the primine is termed the *exostome*, and that of the secondine the *endostome*. This time of the greatest expansion of the foramen coincides with that of the fall of the pollen upon the stigma, so that the pollenous grains, traversing the cells of the *style*, may reach the interior of the ovules, and fecundate them; after which it contracts and closes entirely when the ovule becomes a seed.

THE STYLE.

The superior prolongation of the germen, much narrower than it, and often as fine as a thread. When the carpels are united, the styles or stigmata, or even both, are often likewise united, and this part may even be wanting.

STIGMA.

A naked point without epidermis or cellular tissue, and bedewed with a viscous humour which it secretes. It possesses the property of absorbing liquids, especially the *fovilla*.

THE FRUIT.

This name is given to the carpels when grown ; the ovules, in growing, become seeds. The fruit contains two parts, the pericarp and the seed.

THE PERICARP.

The pericarp is that part of a ripe and perfect fruit formed by the parietes of the fecundated germen, and containing in its interior one or several seeds. It is composed of three parts—the surface or exterior membrane (epicarp), the interior membrane (endocarp), and the intervals between the two (mesocarp). The epicarp often has hairs, glands or stomata; it is easily taken off under the form of a transparent pellicle in the legume of Beans ; it is the velvet skin of the Peach ; it is rarely thick or hard. The endocarp varies greatly in nature, consistency, colour, &c. ; in the legume of Peas it is green like the epicarp ; in the Almond it forms what we vulgarly call the shell ; in the Peach and Cherry it is the bony part of the nut or kernel. The mesocarp is sometimes so fine as scarcely to be distinguishable, while at other times it is thick and fleshy, as in the Apricot, the Peach, &c.

Fruit are said to be *dehiscent* when, on ripening, the pericarp splits open and allows the seeds to be dispersed ; when, on the other hand, the pericarp remains closed throughout the whole of its existence, it is said to be *indehiscent*. Every carpel is more or less two-edged, one edge representing the nudrib of a leaf, and the others the margins united ; these edges are called the sutures, the former the *dorsal*, the latter the *ventral* suture ; to this the seeds are attached in all simple fruits. Fruits are said to be *inferior* when the calyx is placed on the apex of the germ, and *superior* when below the germ.

Class I. Apocarps.

Simple fruits formed of free carpels. Two sections.

DEHISCENT.

FOLLICULUM.

{ A follicle is a carpel opening longitudinally by the ventral suture; pericarp not fleshy, often foliaceous. [Ranunculus.]

LEGUMEN.

{ A legume is a carpel unique and opening longitudinally in two valves, both at the dorsal and ventral suture; pericarp but little or not at all fleshy, of an elongated form, and compressed at the sides. [Bean, Acacia.]

NON DEHISCENT.

DRUPA.

{ A drupe is a mesocarp fleshy; endocarp coriaceous or bony; carpel generally single in each flower, with one or two seeds. [Peach, Plum.]

ACHÆNIUM

{ Or grain is an indehiscent carpel, bony, generally small, containing a single grain, not united with the pericarp. The Strawberry is an accumulation of small grains upon a fleshy torus.

Class II. Syncarps.

Composite fruits formed of two or more carpels of the same flower united. Two orders. *Those fastened to the calyx*, and *those not fastened to the calyx*. The first order has two sections, *dehiscent* and *non dehiscent*.

NON DEHISCENT.

CARIOPSIS.

{ Pericarp one-celled, by abortion, terminated in the flower by two or three stigmata, and united with a single seed. [Wheat, Maize.]

SAMARA.

{ Compartments projecting externally under the form of dorsal wings, from a dry, indehiscent, two or more celled fruit. [Maple, Ash.]

HESPERIDIUM.

{ Epicarps united externally in a coriaceous skin, almost always concealing the juncture of the carpels, which are easily separated by the hand, provided that the endocarp adhere but slightly to the rest of the pericarp. [Citrion, Orange.]

SILIQUA.

{ A silique consists of two carpels united throughout their length in a dry, bivalved fruit, with a thin partition; seeds attached to the two edges of the partition in each compartment. [Cabbage, Radish.]

CAPSULA.

{ A capsule consists of two or several carpels united in a dry, dehiscent, many seeded fruit, in any manner whatever. [Water-Lily, Poppy.]

PYXIDIUM.

{ Capsule opening in the middle by a circular, horizontal fissure. [Chickweed, Purslane.]

The second order has two sections, *fleshy* and *not fleshy*.

NOT FLESHY.

CREMOCARPIUM. { Two or several carpels united with the tube of the calyx, and internally with their single seed; when ripe, separating from a common axis. [Umbelliferæ.]

CYPESELA.

{ A single carpel, by abortion of the others, indehiscent, united with the calyx, and containing a single seed. [Composites.]

GLANS.

{ Pericarp coriaceous or ligneous, indehiscent, unilocular by abortion, containing one or many grains, and surrounded at the base by a cupule. [Hazel, Oak.]

FLESHY.

POMUM.

Several indehiscent carpels, with a cartilaginous or bony pericarp, enveloped by a fleshy calyx, united with them, and indehiscent. The remains of the stamens and the lobes of the calyx are seen at the upper portion. [Apple, Pear.]

PEPO.

Several verticillated carpels, forming a one-celled fleshy fruit, to the internal walls of which the seeds are attached. [Melon, Gourd.]

BACCA.

A many celled fruit, with calyx and pericarp pulpy, indehiscent; seeds surrounded with pulp, and easily separated from their point of attachment. [Gooseberry, Grape.]

Class III. Polyanthocarps.

Fruits aggregated by the approximation or junction of many flowers.

STROBILUS

Or cone is an assemblage of sessile fruits, composed each of a pericarp in the form of a convex scale, and of seeds situated at the base of the pericarp. [Pine, Fir.]

SYCONUS.

A concave, fleshy receptacle, surrounding, more or less, small distinct fruits, and proceeding from a multitude of flowers. [Fig.]

SORUS.

Carpels of several flowers united by the circumjacent floral envelopes, bracts and floral axes adhering together. [Anana, Bread-Fruit, Mulberry.]

THE SEED.

The seed is that part of a perfect fruit which is to reproduce a new vegetable. No naked seeds exist, strictly speaking; but the pericarp is sometimes so fine, and adheres so closely to the seed, that it is with difficulty distinguished.

The seed includes four parts, of which two are never deficient.

THE ARILLUS.

An expansion of the apex of the funicle around the seed, which is only seen in a few species; it may be fleshy, pulpy, or even membranous. This, in the Nutmeg, forms what is called the *mace*.

THE SPERMODERM OR EPISPERM.

An organ which is never deficient, which forms the proper tegument of the seed, and is simple or composed of two membranes, the *testa* and the *tegmen*. The former is the exterior membrane, so called on account of its coriaceous nature; it is smooth, and absorbs moisture with great facility. The latter is the internal membrane; it is not smooth, and does not absorb water.

THE ALBUMEN OR ENDOSPERM.

An intermediate body, which frequently exists between the embryo and the spermoderm; it is composed of diverse matters, fleshy, farinaceous, oily, or analogous to horn. In the nut of the *Cocoa* the milky part is the albumen; it is visible also in Maize, Rice, &c.

THE EMBRYO.

The rudiment of the young plant, protected and nourished by all the envelopes and liquids of which we have spoken. Under the influence of light, moisture, oxygen and heat the plant is developed. This phenomenon is termed *germination*. The embryo consists of

THE RADICLE.

A little simple root, usually fine and pointed, sometimes thick and obtuse, and the length of which varies. In the act of germination the water reaches the radicle first, which is inflated or elongated in diverse ways.

THE PLUMULA,

Or young stem, sometimes scarcely visible. In the seed it is composed of two parts, one beneath the cotyledons, the *tigella*, the other above, the *gemma*.

COTYLEDONS.

Small lateral inflations of the embryo, as many as one or two, or even more. Cotyledons of a foliaceous nature have stomata; grow more or less green in germination; fleshy or farinaceous cotyledons have no stomata, never grow green, and diminish in volume during germination.

CLASSIFICATION OF PLANTS.

Two methods have been followed in classifying plants; one is called the *artificial*, the other the *natural* method: the object of the former is to afford an easy mode to recognize individuals; the latter to arrange them according to their natural affinities. In one point both of these methods agree, viz., the subdividing the vegetable kingdom into groups of more or less importance, as follows: *classes*, *subclasses*, *orders*, *genera* and *species*. The artificial system of Linnæus is that which is at present, with some modifications, universally adopted. The classes of this system are twenty-four in number, and are founded upon characters drawn from the number, situation, proportion, &c. of the stamens. The first eleven classes are characterized by the numbers of stamens, and expressed by names derived from the Greek.

Class 1. Monandria; perfect flowers, with only one stamen.

- Class 2. Diandria; 2 stamens.
- Class 3. Triandria; 3 stamens.
- Class 4. Tetrandria; 4 stamens.
- Class 5. Pentandria; 5 stamens.
- Class 6. Hexandria; 6 stamens.
- Class 7. Heptandria; 7 stamens.
- Class 8. Octandria; 8 stamens.
- Class 9. Enneandria; 9 stamens.
- Class 10. Decandria; 10 stamens.
- Class 11. Dodecandria; 12 to 29 stamens.

The next two classes derive their characters from the number and insertion of the stamens; the number in both being twenty or more.

Class 12. They are adherent to the calyx.

Class 13. They are not adherent to the calyx.

The two succeeding classes are founded upon the relative length of the stamens.

Class 14. Didynamia ; 4 stamens, two of which are longer than the other two.

Class 15. Tetrodynamia ; 6 stamens, four of which are longer than the other two.

Then come four classes founded upon the connection of the stamens with each other.

Class 16. Monadelphia; all the filaments united together to form a tube, the anthers themselves remaining free.

Class 17. Diadelphia; the filaments united into two sets, anthers free.

Class 18. Polyadelphia; the filaments united into more than two sets, anthers free.

Class 19. Syngenesia ; filaments and anthers united into a tube.

The succeeding four classes are founded on the relation of the stamens to the pistil.

Class 20. Gynandria ; stamens adhering to or apparently growing out of the pistil.

Class 21. Monœcia ; stamens and pistils in different flowers, but on the same plant.

Class 22. Dicecia ; stamens and pistils in different flowers, and also in different plants.

Class 23. Polygamia ; stamens and pistils separate in some flowers and united in others, and either all on the same or different plants.

The last class has no flowers properly so called.

Class 24. Cryptogamia ; no stamens or pistil, or those in which these essential organs cannot be discovered.

G E O L O G Y .

G E O L O G Y.

Historical Table of the Revolutions of the Globe.

INTRODUCTION.

THE earth which we inhabit is one of eleven planets which revolve around the sun. It has two motions : one of rotation, which it performs in twenty-three hours, fifty-six minutes, four seconds, and whence results the alternation of day and night ; the other of projection around the sun, or the annual motion, which is completed in three hundred and sixty-five days, five hours, forty-eight minutes and forty-five seconds. Its form is that of a sphere flattened towards the poles. Its surface is about twenty-five million seven hundred and ninety thousand four hundred and forty square leagues, three-fourths of which are occupied by the sea. Its semi-diameter at the equator is about one thousand four hundred and thirty-five leagues. The science which treats of the structure and composition of the globe, together with the changes it has experienced since its first existence, is called *Geology*. The principal fact upon which this branch of human knowledge reposes is the increase of heat which has been remarked in descending mines, and which, at its least expression, is about one degree for about every twenty-five metres of depth ; whence it would result, if we suppose this increase to continue in the same proportion, that, at the depth of a half league, water could no longer remain liquid, and that at twenty or twenty-five leagues the heat would be sufficient to melt most rocks. This central heat has given rise to the supposition that the interior of the globe is in the condition

of an igneous fluid, and that primitively it was altogether but one incandescent mass—a supposition which accords perfectly well with the calculations of astronomers, who demonstrate that our planet has precisely the form which it must have assumed under this hypothesis.

As soon as the temperature of the globe decreased, through the cessation of the calorific cause, a solid crust was formed about the liquid mass, whence resulted a first mode of the formation of rocks, operating from above to below, and which must continue until the whole globe has grown cool. While the planet was incandescent the atmosphere which surrounded it was necessarily filled with an immense quantity of water and sublimated matter, besides the gases which now compose it. In proportion as the process of cooling progressed these materials would be deposited upon the surface of the earth, and augment the thickness of the solid stratum. When the temperature permitted water to remain in a liquid state upon the earth, a new mode of formation would be united with the other, that of precipitation and crystallization. Finally, ruptures of the solid crust of the globe must have taken place in consequence of the pressure of fluids, or of the contraction of the interior parts, diminishing in volume as they grow cool.

FIRST EPOCH.

A very dense and extensive atmosphere, produced by the volatilization of certain substances, easily rendered aeriform, such as water, lead, sulphur, bitumen, mercury, zinc, &c.; temperature and pressure too great to permit any living being to be developed; first cooling; formation of a solid crust, tending to augment every day in thickness; formation of the superior strata of the primordial soils, and of the mineral crystallizations which they include; extensive risings at the surface of the soil; Plutonic eruptions, without flames or scoriified lava; internal effusions between the strata; termination of the first epoch, characterized by the establishment of permanent aquatic basins.

PRIMITIVE EARTHS.

The primitive earths are composed principally of granitic rocks, of schist, mica or talc, and of amphibolous rocks.

Three substances predominate in the rocks of the primary formation : these are *mica*, a very brilliant mineral, of variable colour, and metallic appearance, composed of very fine leaves, easily detached ; *feldzpar*, a mineral often found in red crystals, square and elongated ; *quartz*, a rock-crystal, and very hard body, striking fire with steel. When these three minerals are equally disseminated, in grains more or less thick, the rock which results is called *granite*. As one of the three predominates, or is mixed with some new mineral, the rock takes a different name. Thus primordial rocks, disposed in laminae, where mica or talc predominates, sometimes even excluding feldzspar, are termed schistous, micaceous, or talcous. Amphibolous rocks are the same as the preceding, with the exception that the mica is here replaced by a very brilliant, greenish mineral, with a great tendency to assume elongated forms ; it is called *amphibola*.

USEFUL MATTERS OF THE PRIMARY FORMATION.

Massive granite, fit to be carved into columns, and other stone work of great dimensions.

Kaolin and *petunze*, of which porcelain is made.

Fine *rock quartz*, proper for the fabrication of crystal.

The fine *statuary marble*, *cipolin*, *verd-antique*.

White gypsous alabaster, of ancient formation.

Topaz, *amethyst*, &c.

Muscovy glass.

Labrador and *Amazon stone*.

SECOND EPOCH.

Appearance of organized beings—1st. Vegetables ; 2d. Aquatic marine animals ; 3d. Amphibious reptiles ; tremors of the earth and frequent swellings, producing only extensive undulations upon the surface, and no high mountains, as yet ;

seas of but little depth; numerous and very wide lakes and rivers; a gigantic vegetation of ferns and other acotyledonous plants; at a later period monocotyledonous ones; formation of coal and lignites; plutonic eruptions, without scorified lava; metalliferous injections in veins; internal effusions between the strata; atmosphere rendered less thick, in consequence of the cooling of certain volatilizable matters, which are precipitated upon the earth, such as mercury, zinc, lead, sulphur and bitumen.

EARTHS FORMED DURING THE SECOND EPOCH.

EARTH OF TRANSITION FORMED UNDER THE INFLUENCE OF FIRE AND WATER.

SCHIST.

Rocks arranged in laminæ, or dividing easily in flags, like slates. The schists of Angiers present impressions of very simple animals, belonging to the class of Crustacea, but entirely different from all those known at present. In these strata we meet with touch-stone, oil-stone, black-lead, red-lead, alum, vitriol, anthracite, numerous veins of copper, lead, zinc and iron; mercury, with bitumen, is found in the upper portions.

CALX.

Thick beds, including the greater part of the marbles with mixed colours, such as the gray and black, also the small granite, among others, remarkable on account of the round and white spots, in the shape of stars, formed by fossil Radiata, called *Encrinites*. The most extensive iron mines are found between these calcareous beds and the primary formation; hence also spring the greater number of the mineral waters.

COAL. FREESTONE.

The transition freestone and pudding-stone are generally sterile. They are advantageously employed in carving or building. The pudding-stone sometimes forms also excellent mill-stones, and the freestone good whet-stones. The presence of coal is announced by black rocks, and impressions of vegetables resembling large Ferns.

INFERIOR SECONDARY EARTH.

VARIEGATED FREESTONE.

Thus called on account of their gray or reddish colour, sometimes mixed. They are mingled with pudding-stones and schistous marl, presenting great variety of shade, which has procured for them the name of rainbow marl. Some vegetable fossils are here found, but no animal.

ALPINE CALX OR LIAS.

Tints uniformly gray or blackish; a compact paste rarely granulated, including much clay. Here are found many fossil shells (the arcuated *Grypheus*, a kind of Oyster, flexed in form of a bow); rock salt belongs to this formation, but more especially to the variegated freestone and the rainbow marl.

JURASSIC OR QOLITHIC CALX.

This latter name has been given to them because they appear to form small round granules like fish eggs. We here find the following fossils. *Icthyosaurus*, the head of a lizard, but prolonged into a tapering muzzle, armed with pointed and conical teeth; vertebral column organized as in fish; pelvis small and weak; four limbs, of which the humerus and femur are thick and short, and the other bones, which are flattened and close together, compose, when enveloped by the skin, fins analogous to those of the Cetacea. They live in the sea and crawl with difficulty. *Plesiosaurus*, limbs a little more elongated and more flexible than in the preceding; shoulder and pelvis more robust; neck slender, as long as the body, composed of thirty vertebræ and some more, and terminated by a very small head. *Megalosaurus*, form like that of the Monitor; size so enormous that if we suppose the same proportions as in the Monitor, it must exceed seventy feet in length. *Pterodactylus*, tail very short; neck very long; head large; excessive elongation of the second toe of the fore-foot, which is more than twice as long as the body, and probably served to sustain some membrane which aided the animal in flying. The remains of two species are found, one of which might have been about the size of a common bat, the other of a thrush.

SUPERIOR SECONDARY EARTH.

GREEN FREESTONE.

Characterized by small grains of green matter found disseminated therein.

CRETACEOUS EARTH.

Thick and numerous strata, covering entire countries, and having two varieties; the one like chalk properly so called, that is to say white, soft and tolerably friable; the other altogether hard, and supplying fine stone for sculpture and even true marble. Here are found Oysters, and *Rudistes*, very irregular shells resembling horns diversely flexed, and with uneven surface.

THIRD EPOCH.

Great swellings or erections; sinking of valleys; displacement of seas and lakes; extinction of a great number of organized beings; appearance of new species, such as large mammiferous quadrupeds (*Cetacea* and *Pachydermata*); at the same time appear insects and fresh water fish; remarkable progression in the vegetable kingdom; the dicotyledonous plants are more numerous than the acotyledonous and monocotyledonous; volcanic phenomena more strongly characterized than during the two first epochs; trachytic and basaltic eruptions, with productions more or less bullous and scorified.

EARTHS OF THE THIRD EPOCH.

INFERIOR TERTIARY EARTH.

MARINE FORMATION.

Coarse Calx, composed of calcareous layers of marine formation, between which are inserted accidentally some beds of fluviatile formation. One of these fresh water deposits is often found in the inferior portion; it is that of *plastic clay*; it is succeeded by strata of clay, marl, and sand, in the midst of which are piles of lignite. Coarse calx is the building stone of the Parisians.

FRESH WATER FORMATION.

Gypsous marl and *silicious calx*, composed of beds of marl with Lymneæ and of a compact calx with a fine grain impregnated with silex, in the midst of which are interspersed ovoid masses of gypsum containing numerous bones of terrestrial Mammalia (*Palæotherum*, *Anoplotherum*). The shells included in gypsous marl are particularly those called Lymneæ, Cyclostomes, Planorbes and other fluviatile Mollusca. The *Palæothera*, are Pachydermata intermediate between the Tapir and the Rhinoceros; bone of the nose very short, and seeming to require a little proboscis; six incisors and two canines in each jaw; feet divided into three toes; seven species are found in the lime-pits in the vicinity of Paris, of which the greater portion are about the size of a Horse, the rest of a Hog, Sheep or Hare. The *Anoplothera* are Pachydermata remarkable on account of teeth in a continued series, as we find in the Bimana family, contiguous and without interval, and on account of an unique organization of a cloven foot where the metatarsian and metacarpian bones are not united in a *cannon*. The best known species of these animals, which are peculiar to the lime-pits and coarse calx in the vicinity of Paris, resembled a large Otter, and frequented lakes, in the bottom of which its bones are found incrusted in gypsum.

SUPERIOR TERTIARY EARTH.

MARINE FORMATION.

Sands and marine freestone of Fontainebleau; sands stratified in distinct beds, ferruginous and micaceous; very hard banks of freestone with marine shells in the superior portions of the deposit.

FRESH-WATER FORMATION.

Superior fresh-water calx and mill-stone. Mill-stone is the name given to a silex indented with a multitude of irregular cavities, supplied with silicious filaments arranged much like the reticulated tissue of bones, and spread with an ochrous plaster; these cavities are often filled with clayey marl or sand, and have no communication.

FOURTH EPOCH.

Universal deluge; appearance of aerolites; trains of erratic masses; beds of rolled flints; change in the astronomical position of the planet; extinction of many races of large animals; new races smaller; volcanic phenomena very powerful; erection of the highest mountains; appearance of Man upon the globe; local inundations; sinking of valleys at various stages; diminution of intensity in volcanic phenomena; actual period.

EARTHS OF THE FOURTH EPOCH.

DILUVIAL EARTH.

This earth is composed exclusively of *sand* and *rolled flints* mingled without regular stratification. Diluvial deposits are most usually accompanied with *erratic masses*. This appellation is given to enormous fragments of rock more or less rounded at their angles; some are known which weigh as much as three hundred thousand kilogrammes. These various materials are generally in a movable condition; sometimes, however, we see sands and flints cemented by a marlous or ferruginous clay introduced by infiltrations which still continue at some points. This earth includes no remains of those singular animals which abound in the tertiary soil. Pachydermata, however, still prevail [the Mammoth, Mastodon, Rhinoceros, Hippopotamus, Tapir]. These Pachydermata are attended with numerous remains of Horses, large Ruminantia [Stags, Oxen]; remains are also found of Hyenas, Bears, Tigers, &c. In caverns, called *bony gaps*, in the midst of a red cement, we also find remains of two gigantic Edentata, the *Megatherium* and *Megalonyx*.

FOSSIL ELEPHANT. RUSSIAN MAMMOTH.

From fifteen to eighteen feet high; covered with a thick reddish wool, and with long, stiff and black hairs, forming a crest along the back; enormous tusks implanted in alveoli longer than those of our Elephants; in other respects it resembles the Indian Elephant. It has left thousands of carcases from Spain to the extremity of Siberia, and some are found in every part of North America. Its tusks are so well

preserved in cold countries that they are employed for the same purposes as ivory.

GENUS MASTODON.

These animals had feet, tusks, trunk, and many other details of conformation in common with Elephants. They differed from these in the jaws; where the crown, bristled at its issuing from the gum with thick conical points, presented, in proportion to its detrition, disks more or less wide, which represented the cups of these points. Remains of these animals have been found in both continents. The most remarkable species, and one which appears peculiar to America, is the great Mastodon, whose height is about nine feet; the proportions of the body are more heavy than those of either the Fossil Elephant or the Elephant of our days. There was an error in regarding it as carnivorous.

GENUS RHINOCEROS.

There were three large Rhinoceroses, all two-horned. The species most widely scattered, in Germany and England, and which, like the Elephant, is found even near the shores of the Frozen Ocean, where it has also left entire individuals, had the head elongated, the bones of the nose robust, sustained by a bony nostril partition, not one simply cartilaginous; it was destitute of incisives.

GENUS MEGATHERIUM.

This united a part of the generic character of the Armadillo with some of those of the Sloth, and in height equalled the largest Rhinoceros; its claws must have been of a monstrous length and strength; all the skeleton is of excessive solidity. As yet none have been disinterred except in the sandy strata of South America.

POST-DILUVIAL EARTH.

This earth comprehends the products of present volcanoes, glaciers, morasses, deposits of lake salt, modern formations of sand and calx, fluviatile and marine alluvions, deposits of springs incrusting banks with Mollusca and Zoophytes, flinty and muddy deposits, and finally modern turfs, and the vegetable mould. The organic remains here met with belong

to species analogous with those existing in the countries where they are discovered. It is here only that we meet with human remains, a fact clearly proving the recent appearance of Man upon the earth.

EXPLANATION OF THE STRATA.

Massive granitic earth.

Stratified granitic earth, disposed in beds or layers.

Materials vomited by the central fire, and arranged either at the surface or within the beds. They may be designated by the following names: first and second epoch, plutonic rocks (porphyry and serpentine); third epoch, volcanic rocks (trachyte, basalt); fourth epoch, volcanic rocks (lava).

Aquatic basins.

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Strix,	-	-	-	60	Triton,	-	-	-	-	86
Struthio,	-	-	-	71	Trigla,	-	-	-	-	89
Sterna,	-	-	-	76	Turdus,	-	-	-	-	62

	U.		Vespertilio,	-	-	-	-	34
Umbel,	-	-	Venomous,	-	-	-	-	84
Unio,	-	-	160 Vespa,	-	-	-	-	137
Urias,	-	-	107 Vipera,	-	-	-	-	84
Ursus,	-	-	75 Viverra,	-	-	-	-	39
Uranoscopus,	-	-	36 Vultur,	-	-	-	-	58
			89					
						X.		
	V.		Xiphias,	-	-	-	-	90
Vaginalis,	-	-	74					
Vanellus,	-	-	71					
Vaginulus,	-	-	104					
Vanessa,	-	-	139					
Variegated Freestone,	-	-	179 Yunx,	-	-	-	-	67

THE END.





